

HORTICULTURAL ABSTRACTS.

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Abstracts. Initiated abstracts in the present number are by H. Martin, D.Sc., of the Agricultural and Horticultural Research Station, Long Ashton, and by N. B. Baggenal, A. M. Massee, H. L. Pearse, W. S. Rogers, H. Shaw, and H. M. Tydeman of the East Malling Research Station.

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Horticultural Abstracts

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HORTICULTURE—MISCELLANEOUS.

798. U.S. DEP. AGRIC. (PENNINGTON, C. E.). 016 : 63
List of bulletins of the agricultural experiment stations for the calendar years 1933 and 1934.
Misc. Publ. U.S. Dep. Agric. 232, 1936, pp. 81.
 This most useful publication contains three sections. In the first are the titles of bulletins in alphabetical order of experiment stations and in numerical order of bulletins, the authors' names being given in each case. The second consists of an author index and the third of a subject index. It is understood that a similar publication dealing with the bulletins issued in 1935 and 1936 will be issued shortly.
799. PATENT OFFICE, WASHINGTON, D.C. 634/5
Calif. Citrogr., 1937, 22 : 601.
 Attention is called to a notice issued by the Patent Office at Washington pointing out that the grant of a plant patent is not in any sense an endorsement by the Government of high quality or merit in the plant patented. The only implication that can be drawn from the grant of a patent is that the plant is "distinct and new".
800. AYLEN, D., AND ROBERTS, R. H. 631.459
Soil conservation.
Bull. Minister Agric. S. Rhodesia 1019, 1937, pp. 80, being reprinted from *Rhod. agric. J.*, 1937, 34 : 90-120 and 173-222.
 In this paper, written to show how best the dangers of erosion can be avoided in S. Rhodesia, the authors deal in the first instance with examples of erosion in other lands which might in the light of present knowledge have been avoided. Next they consider in particular veld and gully erosion and the steps necessary to prevent it. Further they show how to avoid erosion on cultivated land by protective works, proper cultivation and other measures, and lastly they devote a chapter to the construction and maintenance of ridges, etc. The whole bulletin is profusely illustrated with photographs and diagrams and should prove useful far beyond Southern Rhodesia.
801. STEPHENSON, R. E., AND SCHUSTER, C. E. 631.43 : 631.811
Physical properties of soils that affect plant nutrition.
Soil Sci., 1937, 44 : 23-36, bibl. 11.
 The report is based on a study of some 30 soils, mostly in walnut and filbert orchards, in U.S.A. It is shown that root development is correlated closely with the degree of soil aeration and that differences due to aeration are most marked at a depth of 3-5 ft. The zone of greatest development of absorbing roots is confined fairly closely to the zone of humus accumulation, in which zone is to be found the greatest amount of supposedly available nutrients. The deeper tree roots serve chiefly for drawing the necessary moisture from deeper soil, and the moisture problem becomes most serious in shallow soils. A soil structure extending to a depth of at least 8 ft. is

necessary for satisfactory deep rooting and the use of moisture, and the limiting factor in tree growth and yield where irrigation cannot be practised is in the 3-10 ft. level. The early part of the paper discusses the structure of various types of soil.

802. ANDERSON, M. S., AND NOBLE, W. M. 631.8 + 631.42

Comparison of various chemical quick tests on different soils.

Misc. Publ. U.S. Dep. Agric. 259, 1937, pp. 23, bibl. 49.

Of recent years claims have been made for a large number of so called quick test outfits which are intended to serve as an index of plant growth on the soils tested. Comparable tests have now been made on a group of widely diversified soils with several of these outfits. Tests were for available phosphorus and potassium and for acidity, lime requirements and nitrates, and were made with seven different outfits. Results obtained by two observers with the same set on a particular soil agreed fairly well, but results by different methods on the same soil did not agree. No information is available as to how crop response agreed with the results obtained. As a result the use of any one of these tests is neither recommended nor condemned. They are thought to be of particular value under certain circumstances, but the scope of their usefulness is not yet clearly defined.

803. HILL, H. 631.811.9 : 634/5

Minor elements affecting horticultural crops.

Sci. Agric., 1936, 17 : 148-53, bibl. 20.

The author notes briefly recent experimental work on the effect of minor elements. *Boron.* Boron deficiency is found to be responsible for brown heart in turnips. Potato crops have been injured by the use of commercial fertilizers containing appreciable amounts of boron, but growth of potatoes in sand cultures not containing boron resulted in poor vigour, yield and quality of tuber. One part per million in the solution produced normal growth. The injection of boron into trees has been shown to control such physiological diseases of apples as corky-core, drought spot and blotchy cork. *Copper.* Peat soils are often found to be unproductive unless copper is added, and the addition of copper sulphate is recommended in Holland, New York State, and elsewhere on such soils. Although it has been found possible at Ottawa to grow tomatoes, chrysanthemums, strawberries, turnips and other plants in sand cultures without copper, it is possible that very minute amounts may have been available as impurities in the chemicals or obtainable from the glazed pot containers. *Manganese.* Deficiency of manganese brings about a chlorosis extremely like that due to lime or iron deficiency. It is most apt to occur on alkaline soils. Chlorosis due to this deficiency is reported in many horticultural crops, e.g. spinach, tomatoes, potatoes, lettuce, onions, mangels, etc. *Zinc.* Zinc sulphate is effective in controlling little leaf of fruit trees, pecan rosette and bronzing of tung oil trees.

804. CHOUARD, P. 612.014.44 : 635.1/9 : 631.588.1

L'emploi de la lumière en horticulture. (*The use of light in horticulture.*)

Bull. mens. Soc. nat. hort. Fr., 1936, 3 : 358-72, bibl. 35.

The author in this interesting summary first deals with the physiological principles governing the action of light on plant growth under the following headings:—(1) chlorophyll formation; (2) pigment formation; (3) general nutrition; (4) formation of growth stimulating substances namely (a) vitamins and (b) hormones and (c) its stimulating effect on seed germination; (5) flowering and periodicity, including a brief note on vernalization. Next he considers the different methods and apparatus for applying artificial light:—(1) type of lamp used; (2) permanent lighting or additional lighting; (3) mode of using additional lighting. He notes the results of recent work on the following problems:—differentiation of plants into short and long day plants and plants indifferent in that respect; combination of heating and lighting during the winter for vegetables such as haricots and radishes—he previously stresses the point that heating without additional light may upset the physiological balance of plants in winter;—combination of lighting, heating and CO₂ manuring; in Germany he notes that specially treated wood charcoal

is used for CO₂ manuring. It is watered with methylated spirit before use and is then put into the frame and lighted, when it produces 100 litres of pure CO₂; the use of neon light in Holland with notes on Roodenburg's work; growth of plants in ordinary dwelling houses with notes on the particular treatment necessary for plants normally demanding full sunlight or half shade or shade. Finally he makes brief suggestions as to how horticulturists should attempt to make use of the above work noting that, although success from a physiological standpoint is certain, economically each step must be tried on a small scale before application on a large.

805. DASTUR, R. H., AND SOLOMON, S. 581.13 : 535.6
A study of the effect of blue-violet rays on the formation of carbohydrates in leaves.

Ann. Bot., Lond., 1937, 1 : 147-52.

Experiments in which various plants were exposed to light from carbon arc lamps rich in blue-violet rays or to an ordinary gas-filled electric lamp or to a mixed beam showed that more carbohydrates were formed in the leaves exposed to the carbon arc lamp than in those exposed to the gas-filled lamp and that carbohydrate content under the mixed beam was somewhere intermediate between the two. Thus the importance of the blue-violet rays in the photosynthetic process is demonstrated quantitatively. The differences were statistically analysed and proved to be of high significance. The technique employed is fully described.

806. ROODENBURG, J. W. M. 612.014.44 : 631.588.2
Der Einfluss der Tageslänge im Zusammenhang mit der künstlichen Pflanzenbeleuchtung im Winter. (The effect of length of day in relation to artificial lighting in winter.)
Ber. dtsch. bot. Ges., 1937, 55 : 1-32, bibl. 34 (being *Meded. Lab. Tuinbouwpl. Wageningen* 26).

This comprehensive review of the present position is summarized as follows:—In investigating the claims made for artificial lighting of glasshouse plants in winter it was found essential to determine not only the character and intensity of the light but also the length of irradiation. It was found by experiments with cucumbers that with average intensity of light and times of lighting leaf development is proportional to the amount of light (duration \times intensity). This leaf development bears a direct relation to CO₂ assimilation. Photoperiodic phenomena follow quite different rules. The specific influence of length of day is chiefly noticeable in flowering and bears no relation within wide limits to light intensity. The effect depends wholly on the length of the daily lighting. The fact is thus explained that the flowering of some plants under particular conditions can be helped even with the smallest possible light intensity. The use of such low intensities is only important when supplementing an over short day length and it is of practically no importance to CO₂ assimilation. Withrow's method is, therefore, more suited to subtropical regions, where the daylight in winter makes CO₂ assimilation possible in sufficient amount. The effect of length of day was very noticeable in trials with strawberries, which were grown in a glasshouse in early autumn before any question of light deficiency arose. The check in growth which threatened to set in with decreasing length of day at the end of September was warded off by long day application of a quite low light intensity (20 Lux bulbs), which could not have increased CO₂ assimilation. Length of day was found to have a very marked influence on the growth in length of leaves and flower stalks. In the winter low power lighting was insufficient to support strong growth, and for this increased CO₂ assimilation together with fairly strong lighting are essential (500 Lux neon light). Finally a theory is suggested which may explain the physiological influence of length of day. The lack of any connexion with CO₂ assimilation and its very thorough agreement with the behaviour of the cell growth hormones makes it probable that the duration of the daily light period controls in one way or another growth substance conditions in the plant. The agreement of length of day and definite temperatures (vernalization) and their effects can thereby be explained.

807. BROWN, C. A. C. 631.588.1 : 631.544.1

Electrical heating for horticultural purposes.

J. Minist. Agric., Lond., 1937, 44 : 552-61, bibl. 10.

Glasshouse and soil heating are discussed from the standpoint of cost and practicability and the conclusion is reached that, while the use of electricity for horticultural heating is technically sound, it must be realized that it is only economic where certain favourable conditions exist. As a medium of labour-saving in the small nursery it could probably be used with advantage. The need for taking expert opinion before installing any system is emphasized.

808. STOUT, G. J., AND OTHERS. 631.544.1 + 631.588.1

Methods of heating hotbeds.

Bull. Penn. agric. Exp. Sta. 338, 1936, pp. 22, bibl. 54.

Three years' experiments on the heating of hotbeds by electricity, anthracite, kerosene, gas and farmyard manure are summarized. It was found practicable to grow satisfactory vegetables in all cases, the chief differences being economic, costs of installation and working varying considerably. As regards electricity a very great deal was found to depend on proper insulation and weather stripping, and without these the energy consumption for the required amount of heat doubled. The actual method of electrical installation was also of the greatest importance, the energy consumption differing by 400% among the several methods studied. Temperatures of electrically heated cables at 4 in. depth varied considerably with moisture content and with differences in the nature of the surrounding medium whether sand, loam or peat moss. [Attention is drawn to the good bibliography.—ED.]

809. OTT, M. 577.16 : 634/5-1.8

Einfluss der Düngung auf die Vitaminbildung in landwirtschaftlichen und gärtnerischen Erzeugnissen. (The influence of manuring on vitamin formation in agricultural and horticultural products.)

Forschungsdienst, 1937, 4 : 13-8, bibl. 14.

The author is concerned with vitamin C, vitamin A and provitamin A (or carotin) content of food plants. He briefly notes previous German work on the vitamin content of particular horticultural products as affected by manuring. He considers that a concerted effort should be made by a large number of institutes to investigate very thoroughly the whole problem and that the investigation of small sections of it, one at a time, is not enough. In the programme outlined by him the following points are stressed as being essentials:—(1) Determination of vitamin content of horticultural foodstuffs and juices, both fresh and preserved and the effect of cooking on that content. This entails a determination of the influence of soil reaction; the influence of manuring both with single and mixed fertilizers and manures; the influence of the form in which fertilizers or farmyard manures are given; the influence of different types of soil (this would mean the determination of vitamin content in the soil at different times of the year); influence of such factors as light, climate and weather conditions; variations in vitamin content in the plant during growth, ripening and storage. It is proposed to start investigations at the agricultural experiment station at Darmstadt in 1937 on the following plants:—grass, spinach, tomatoes, potatoes, carrots, celery, onions and cabbage. The influence on vitamin content of lime in the soil, of different fertilizers in different amounts, and of complete mineral nutrition with and without farmyard manure will all be tested.

810. SCHMIDT, L. 577.16 : 631.8

Der Stand der Vitaminforschungen unter besonderer Berücksichtigung des Düngungseinflusses. (The present position with regard to vitamin research with special reference to the effect of manuring.)

Forschungsdienst, 1937, 4 : 177-81.

The author enumerates the three fat-soluble vitamins A, D and E and the water-soluble vitamins B, C and H, and some of the more common substances in which they occur. He notes isolated

investigations on the results of manuring on vitamin content in plants. Finally he gives a list (also given by Ott, see abstract 809) of some 23 horticultural products and their vitamin C and carotin contents in mg. per 100 g. according to Ragnar Berg in *Die Nahrungs- und Genussmittel* (5th edition).

811. PFAFF, C. 577.16
 Vitaminbestimmungen in Pflanzen. (Vitamin determination in plants.)
Forschungsdienst, 1937, 4 : 182-3, bibl. 5.

In these notes the author briefly criticizes different methods of detecting carotin (or provitamin A), vitamin C, and vitamin B1.

812. AJON, G. 581.192
 Il rapporto di equivalenza nel mondo vivente. (The relation of equivalents in the plant and animal world.)
Ann. Staz. Frutt. Agrum. Acireale, 1937, 14 : 161-94, bibl. 12.

The author considers that a great deal could be learned from a careful chemical analysis of the ash of plants as to the optimum conditions for their nutrition and growth. He assumes that the important factor is the ratio of total alkaline equivalents to total acid equivalents in the ash. The alkaline equivalents considered for the purpose are the oxides of sodium, potassium, magnesium, calcium, manganese, iron, while the acid equivalents are the oxides of phosphorus, sulphur and silicon and the amount of chlorine. How the so-called equivalents corresponding to the actual amounts are then determined may be seen from the following examples:—If the percentage of K₂O in the ash of a plant is 35.34, then the equivalent will be $\frac{35.34}{94.208}$ (i.e. molecular weight) = $\frac{35.34}{47.104} = 0.7502$. In the case of iron oxide the equivalent

weight is $159.68 \div 6$ or 26.6133, and if the percentage found in a plant is, say, 2.32, then the equivalent will be $2.32 \div 26.6133 = 0.0872$. It is realized that the relation of alkaline to acid equivalents will differ from organ to organ in the same plant and will differ under different environmental and presumably nutritional conditions, but it is considered that examinations of particular parts of extremely healthy and well grown plants (possibly seeds) would throw light on the above relationship and so eventually on ideals to aim at in nutrition and general care.

813. DESAI, M. C. 581.13 : 581.821.1
 Effect of certain nutrient deficiencies on stomatal behaviour.
Plant Physiol., 1937, 12 : 253-83, bibl. 32.

The possible effects of nutrient deficiency (potassium, phosphorus and nitrogen) on the stomatal behaviour of certain plants, including maize, field pea, kidney bean, tobacco and *Tradescantia*, were studied. Deficiency of nutrients and also excess of potassium reduces the response by the stomata to light, water and other environmental factors. This behaviour appears to be connected with the general metabolism of the plant, and is controlled by the leaf activities of photosynthesis, respiration and transpiration. The condition of the stomatal mechanism itself does not change in deficient cultures.

814. GUSTAFSON, F. G., AND DARKEN, M. 581.175
 Further evidence of the upward transport of minerals through the phloem of stems.
Amer. J. Bot., 1937, 24 : 615-21, bibl. 3.

Experiments are described from which it is deduced that both xylem and phloem function in an upward transport of minerals. The plants used were *Sedum*, *Bryophyllum*, willow and geranium.

815. WILSON, A. R.

581.084.1

Apparatus for growing plants under controlled environmental conditions.*Ann. appl. Biol.*, 1937, 4 : 911-31, bibl. 10.

This detailed and illustrated account should prove useful to those who are faced with the problem of growing plants under severely controlled environmental conditions in the laboratory and are provided with adequate funds for the purpose. In an appendix is set out the cost of materials used in the construction of the apparatus. Without allowing anything for labour it amounted to £80. The author summarizes as follows:—"Details are given of modifications of a Rothamsted Controlled Environment Chamber. These include an inexpensive cooling apparatus depending on the circulation of air through a car radiator, through which cold or iced water is circulated by an electrically operated centrifugal pump. This apparatus enables temperatures down to 5° C. to be maintained at a room temperature of 16-18° C. Two types of humidifier are described. That finally adopted depends upon the passage of air through a fine water mist created by an atomizing device, the temperature of the water being maintained a few degrees above that of the air in the chamber. A method of drying air by passage over calcium chloride is described. Details of an inexpensive, simple and accurate, lineametric hair-operated hygrostat are given. This instrument controls humidity within 2%. Various minor modifications such as rough control of wind velocity within the chamber and a semi-automatic watering device are described."

816. LEK, H. A. A. VAN DER, AND KRIJTHE, E. 631.535 : 577.15.04

Bevordering van de wortelvorming van stekken door middel van groeistoffen.
(Stimulation of the rooting of cuttings by growth substances.) [English summary.]

Med. LandbHoogesch. Wageningen, 1937, deel 41, verhandeling 2, pp. 50, bibl. 32, Veenman and Zonen, Wageningen, 1.50 Fl.

The authors report experiments on the practical use of β -indolylacetic acid for promoting root growth in cuttings. Three methods of applying the substance were tried, namely, as a lanolin paste, continuous absorption of water solutions from little cups attached to the base of the cuttings, and treatment of the basal ends of the cuttings with water solutions of various concentrations for different times before planting. The results from the first two methods were quite negative with the varieties tested. The third method was much more promising and positive results were obtained with *Wisteria sinensis*, *Pyracantha crenulata*, *Olearia Haastii*, *Daphne Laureola*, *Stranvaesia Davidiana*, *Prunus cerasifera* (2 varieties), and *Cydonia oblonga* (3 varieties), root formation being stimulated and accelerated. With ten other species, however, including *Ilex verticillata* and *Coloneaster salicifolia*, results were insignificant or quite negative; but the authors suggest that in these cases the lack of positive results may have been due to the advanced season (October, November) at which the experiments were conducted. As regards treatment it was found that a more concentrated solution with a shorter immersion time was generally more effective than a weaker solution with a longer immersion period. The responses obtained could be roughly divided into two groups, (a) acceleration and strengthening of the type of root formation which occurs without treatment, and (b) stimulation of other types of root formation, i.e. internodal in a species which normally produces nodal roots, and vice versa.

H.L.P.

817. DAVIES, W., AND OTHERS.

577.15.04

The effect of ascorbic acid and certain indole derivatives on the regeneration and germination of plants.*Ann. Bot. Lond.*, 1937, 1 : 329-51, bibl. 28.

New methods of preparation of the indole derivatives ensuring that there is no contamination with heteroauxin are described. Heteroauxin and β -indolylpropionic acid caused epinastic curvatures of tomato, a result not obtained with other indole preparations or with ascorbic acid. Low concentrations of all the compounds stimulated root development in willow cuttings

while ascorbic acid also promoted shoot growth. High concentrations produced retarding or lethal effects. All compounds except ascorbic acid had retarding effects in any concentration on the germination and subsequent growth of oats and mustard and cress grown in Petri dishes containing 3 filter papers and 10 c.c. of solution, this being traced to retardation of root growth, though direct contact of the medium with the shoot yielded greatly increased growth. With ascorbic acid, however, the effect was stimulating both in root and shoot growth in low but not in high concentrations. The effects shown by ascorbic acid differentiate it clearly from the indole derivatives and presumably from the auxins generally. Its stimulation of growth is not an immediate local effect and it can evidently be rapidly translocated. The concentration found most efficient for growth promotion in these preparations was 1 in 100,000; at higher and lower concentrations efficiency decreased.

818. ZIMMERMAN, P. W., AND HITCHCOCK, A. E. 577.15.04
Comparative effectiveness of acids, esters and salts as growth substances and methods of evaluating them.

Contr. Boyce Thompson Inst., 1937, 8 : 337-50, bibl. 6.

The paper consists of a review of responses of plants to growth substances, a discussion of methods employed for testing purposes and results obtained with 21 salts prepared from various acids previously reported as growth substances.

819. THIMANN, K. V. 577.15.04
On the nature of inhibitions caused by auxin.

Amer. J. Bot., 1937, 24 : 407-12, bibl. 25.

In view of the parallel behaviour of roots and buds in regard to auxin inhibition it is suggested that roots, buds and stems all behave in a comparable way, their growth being inhibited by relatively high and promoted by relatively low auxin concentrations. [From author's summary.]

820. LEONIAN, L. H., AND LILLY, V. G. 577.15.04
Is heteroauxin a growth promoting substance ?

Amer. J. Bot., 1937, 24 : 135-9, bibl. 6.

From experiments which are here described it is concluded that heteroauxin is a growth-inhibiting rather than a growth-promoting substance. The abnormal rooting of cuttings under the influence of heteroauxin possibly comes about because it acts as an irritant inducing the inherent growth substances of the protoplasm to develop in larger quantities and to concentrate in the region invaded by the heteroauxin, just as rooting may be induced by wounding or other mechanical irritation. If heteroauxin and similar substances were growth-promoting, what would be the explanation of the fact that when applied to the soil they induce root growth but fail to benefit the plant, which remains stunted and sickly? Even the deadly carbon-monoxide gas will induce rooting, but it is hardly a growth substance. The use of the word "hormone" is deprecated on the ground that no relationship has been established between animal hormones and the growth substances of plants.

821. GUSTAFSON, F. G. 581.163 : 577.15.04
Parthenocarpy induced by pollen extracts.

Amer. J. Bot., 1937, 24 : 102-7, bibl. 12.

The pollen of some plants is shown to be a chloroform-soluble material which initiates growth of the ovary and in some instances causes seedless fruits to be formed. It is thought that the hormone or hormones in the pollen are either identical with some of the growth hormones or at least closely related to them.

TREE FRUITS, DECIDUOUS.

822. MARANI, M., AND OTHERS. 634.25
 Comportamento, nei frutteti d'osservazione, di due varietà di pesco : " Precoce di Hale " e " Gaillard 2 ". (**Trials of the Hale's Early and Gaillard 2 peach varieties.**)

Riv. Frutticoltura, 1937, 1 : 130-45, bibl. 11.

Trials of these two peach-varieties have shown that under Northern Italian conditions Gaillard 2 can be strongly recommended to take the place of Bonvicini in view of its excellent and greater capacity for setting fruit. With regard to Hale's Early a tendency to poor colour makes further trials essential.

823. RICCHIONI, V. 634.35
 La coltura del mandorlo in Terra di Bari. (**Growing almonds in the region of Bari.**)

Ital. Agric., 1937, 74 : 159-71.

An account is given of the normal methods of almond growing in this most important almond growing district of Italy. Costings are given up to the seventh year, at which time the trees should start bearing. Wild almonds are used as stocks and a very large number of different varieties as scions. A plea is uttered for an examination and testing of varieties which will not only grow well, but will yield good crops of almonds acceptable on the market. Notes are given on the organization of the almond trade in Spain and in California.

Breeding.

824. BERKUT, O. D. 631.523 : 634.11 : 634.13
On breeding of apple×pear hybrids. [Russian, English summary 10 ll.]

Sci. Fruitgrowing, Mitchurinsk, 1937, No. 1, pp. 22-4.

As a result of pollinating apple with pear varieties (5,785 blossoms) the author obtained seeds. Some hybrids raised from the latter bore distinct features of paternal prepotency. After developing 4 leaves, these seedlings ceased growing, and some of them died. Evidently they had now passed the critical stage of development. During the first growing season the seedlings on the average grew less in height than the maternal plants.

825. PISKAREFF, V. I. 634.1/8-1.531 : 581.142
Determining the germinability of tree-fruit seed by staining methods. [Russian, English summary 1½ p.]

Sci. Fruitgrowing, Mitchurinsk, 1937, No. 1, pp. 51-63, bibl. 10.

An account is given of the determination, by means of staining, of absolute germinability (viability) of all types of tree fruits grown in the U.S.S.R.'s Middle Zone. The absolute germinating capacity of apple, pear and cherry is found to coincide with that of stratified seed as established by germination test. There is a divergence between the absolute and real germinability of plum and sloe seed, depending on the length of the after-ripening period. In the case of all common fruit trees, the viability of the seed remains the same irrespective of whether the seed is dried, stratified, or has had the seed coat removed. When seed is stratified badly, divergencies in viability are found to occur between dried and stratified seeds especially in apples and pears. Prior to the staining of the seeds the seed coats have to be removed. With the stone fruits the stone must be removed and the seeds soaked in water for 22-24 hours. Apple seed is soaked for 22-24 hours, pear seed for 24-30 hours. Stratified seed need not be soaked. The best recommended dyes are :—Indigo-carmine and Eosin bluish. The author recommends for routine work the following concentrations of dyes :—1 : 800 for completely soluble Indigo-carmine, 1 : 1,000 for slightly soluble Indigo-carmine and 1 : 10,000 for Eosin bluish. Seeds which entirely

refuse to take up the dye may be considered as viable, while those which absorb it wholly or partially should be regarded as non-viable. Some of the partially dyed seeds may develop under laboratory conditions.

826. URSULENKO, P. K. 634.11-1.8
Influence of mineral fertilizers on the development of apple-tree seedlings.
 [Russian, English summary 1 p.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 1, pp. 28-37.
 This paper deals with field experiments on two types of soil. [Number of trees used in experiment not stated.—Ed.] They indicate that the chief effect of fertilizers is to improve the quality of the seedlings. Experiments showed that only combinations with nitrogenous fertilizers produced a positive effect. The effect of fertilizers on seedling development was considerably lower on weakly alkaline black soil than on highly degraded black soil. The information is tabulated.

*Propagation.**

827. PEARSE, H. L., AND GARNER, R. J. 634.1/2-1.541.11-1.535 : 577.15.04
A note on the use of α naphthalene acetic acid for rooting soft-wood cuttings of fruit tree stocks.
J. Pomol., 1937, 15 : 248-51, bibl. 5.

The authors note the results of preliminary attempts to stimulate the rooting of fruit tree cuttings with α naphthalene acetic acid. The solutions were made by dissolving the acid in 1-2 c.c. of 95% alcohol and making it up to the required volume with tap water. The cuttings freshly taken, had their lower leaves removed and were then put with their basal ends immersed for 1 inch in freshly prepared solutions. Solutions containing from 10 p.p.m. to 50 p.p.m. were generally used for any given species of cutting. After immersion, which lasted from 6-18 hours, the bases were carefully rinsed in tap water and the cuttings were planted in sand in a frame supplied with bottom heat. The following material was used:—*Prunus cerasifera*, Myrobalan B plum rootstock; *Pyrus communis*, Malling free pear rootstocks Nos. C8 and C2; *Ribes nigrum*, black currants; *Ficus Carica*, fig. It was found that immersion for 12 hours in a 30-40 p.p.m. α naphthalene acetic acid solution improved rooting markedly in all the above, results being particularly promising in the case of the pear stocks, since these are normally difficult to propagate vegetatively.

828. PASSECKER, F. 631.535 : 634.11 + 634.21
Ungeschlechtliche Vermehrung von Obstsämlingen.† (Vegetative propagation of apple seedlings.)
Gartenbauwiss., 1937, 11 : 324-8.

The author describes further experiments on the vegetative propagation of fruit trees. An apple seedling, which had previously been propagated in the stool bed, was potted up in autumn and the single one-year-shoot present shortened to 9 in. The pot was left over the winter in an unheated room. Growth started in February and young shoots developed from each of the 5 buds present. At the beginning of March the whole plant was covered with a glass cylinder and was put in a heated room close to the window at a temperature of about 20° C. After three days aerial roots had formed on the wood where the young shoots were growing out. These roots were about the thickness of a knitting needle and were covered with a reddish skin. Three of the topmost shoots were cut off in mid-March, two of them with a wood shield at their base much like those taken when budding, the third with a 2 cm. piece of stem attached. The aerial roots remained attached to these three pieces. The three pieces were then planted in a pot

* See also 816-821.

† See also *H.A.*, 1937, 7 : 283.

filled with very sandy leaf loam, the top layer being fine sand. The pot was enclosed in a glass cylinder. Further growth was fairly slow, though at the end of 2 months the roots were found to have made vigorous growth in two cases. But in the third, that where a piece of stem remained attached, no rooting took place initially. The wood of the stem piece turned brown and died. The author considers that, unless some means, such as for instance bottom heat, is devised capable of accelerating the process, the old stooling method would appear to be preferable. Successful attempts to root green apricot cuttings are also described. Apricot seeds stratified during the winter germinated in January. The young seedlings were grown indoors in pots and developed somewhat rank shoot growth. These shoots were cut to a length of 5-6 cm. and put in a shallow pot filled with sandy leaf mould soil with a 1 cm. layer of pure sand on top. A glass covering enclosed the whole pot. The cuttings rooted after 14 days, and further growth, both of root and top, was satisfactory. It is stated that further, presumably similar, attempts to root green cuttings of apple and pear seedlings and bird cherries were equally successful. The identity of the varieties concerned is not disclosed.

829. GARDNER, F. E. 634.11-1.535-1.534
Etiolation as a method of rooting apple variety stem cuttings.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 323-9, bibl. 2.

Paper tubes $\frac{3}{8}$ in. in diameter and $5\frac{1}{2}$ in. long were made of black mulching paper and tightly fastened with copper wire over the ends of shoots on orchard apple trees before spring growth started. The tube is so contrived that the new growth can push its way into the light through the closed end of the tube. The lower part of the shoots is thus etiolated and when such shoots are detached from the tree and placed in propagating beds rooting will in many varieties occur in a few days. This method of etiolation on the tree has proved the easiest of a number tried including etiolation by means of insulating tape, black cloth bags and the covering of entire young trees with large boxes. It should be noted that the tight copper wire binding is an important accessory aid to the production of roots. The method has been applied successfully to lilac, with indifferent results to pears and with no success to sweet and sour cherries. With apples the response varies with the variety, but a 40% success is considered poor. The place of occurrence of the root primordia also differs with the variety: thus it may be within the bud axil, to one side and below the bud, or at some undetermined point on the internode.

Rootstocks.

830. TYDEMAN, H. M. 634.11-1.541.11 : 631.523
Studies on new varieties of apple rootstocks.
J. Pomol., 1937, 15 : 165-90, bibl. 9.

The author describes 3 trials extending over six years made with Lane's Prince Albert apple variety worked on 19 selected rootstocks clonally raised from hybrids of 2 dwarfing stocks, Malling No. VIII (French Paradise) and Malling No. IX (Jaune de Metz) bred at the John Innes Institution in 1923. In the first units consisted of 15-35 trees on each of 10 stocks with 45 trees on IX for comparison. In the second units were of 50 trees on each of 9 stocks with controls on IX and VII. In the third units were of 40 trees on each of 19 stocks with controls on IX and VII. Results in all three trials agree. A great variation in vigour was found, trees on eight of the selections being definitely less vigorous than those on Malling IX and those on seven of the selections being definitely more vigorous than those on Malling VII at 3 years old. It was found with only slight exceptions that the size of the swelling at the union decreased with increased vigour in the tree. A very clear and consistent relation was found to exist between the dwarfed character and the productivity of the trees, trees on the more vigorous stocks producing less blossom and less fruit in their earlier years than those on the more dwarfing stocks. Thus in the first year of flowering the trees on the most dwarfing of the series bore many more blossom trusses than the control trees on Malling IX. Data are given of the relative susceptibility of the trees

in a single season to leaf scorch, scab, canker, mildew, crown gall and blossom weevil. Little if any evidence is forthcoming of a direct rootstock influence on the degree of attack of any of these on the scion.

831. BLAIR, D. S.

634.11/12-1.541.11-2.111

Influences of rootstocks on apple tree performance.*Seventy-third annu. Rep. Nova Scotia Fruitgrs Ass. for 1936*, 1937, pp. 79-85.

The disadvantages of seedling rootstocks are mentioned. Formerly French crab was the most extensively used seedling stock in Canada and U.S.A., but of late years McIntosh, Canada Baldwin, Spy and other common varieties and, in particular for Northern districts, the hardy Russian varieties Antonovka, Anis, etc, have supplied much of the seed from which such rootstocks are raised. Methods of raising vegetative stocks are then described and the individual characteristics of the East Malling numbers are discussed. Allusion is made to the rootstock experiments in progress at Canadian research stations, particularly at Kentville, in co-operation with East Malling. Until definite information is forthcoming, growers in the Annapolis and Cornwallis Valleys are advised to continue to use seedling rootstocks, more especially as many of the vegetative rootstocks have been found to be susceptible to collar rot, to which the seedling stocks mentioned above are definitely resistant. Seedling French crab stocks are often badly injured or destroyed by cold in Canada. Such crab stocks as Quaker Beauty, Martha, Hyslop and Transcendent under trial at Ottawa for many years together with the hardy Russians Anis and Antonovka have never lost a tree from cold root injury. The process of double working and its advantages in frame building under severe Canadian conditions is discussed.

832. ROBERTS, R. H.

634.11-1.541.11-1.541.3

A third experience in producing stock effects with ring grafts.**Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 296, bibl. 3.

For the third time stock effects upon the growth of nursery trees was secured by grafting a ring of bark of a stock variety upon yearling trees. As before, a difference was seen in the effect of different rings. The effect of a ring upon growth varied with the stock and scion combination. When bark of the red-wooded, red-barked Hopa crab was used for rings, the new xylem under Hopa rings had a red colour, indicating that it arose from the cambium of the bark. If the Hopa crab ring did not entirely surround the stem, a gap of tissue from the stock formed between the areas of red-coloured xylem.

833. BRASE, K. D., AND TUKEY, H. B.

634.11-1.541.11

The relation between the size of apple seedling rootstock and size of orchard tree.*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 298-304, bibl. 4.

It is claimed from the data presented, taken from 6-year-old orchard trees, that the original nursery size of seedling rootstocks used in the experiment here described played little if any part in the growth of the trees budded upon them, nor is it considered that the genetic constitutions of the rootstocks were responsible for the growth made by the trees. Differences in growth were apparently occasioned more by digging and planting, method and time of budding and the condition of the seedling rootstock at time of budding. Retransplanting to a fresh site after trees had been established in an orchard resulted in an equalization of growth in larger and smaller trees and in a masking of any possible inherent vigour of the rootstock.

834. LINCOLN, F. B.

634.11-1.541.11

A method for appraising apple clonal stock material in the nursery.*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 307-13.

A procedure has been devised to bring out within five years the various characteristics of possible new apple rootstocks whose potentialities are still unknown, and it is here discussed. The

* See *Ibidem* 32 : 328, H.A., 1935, 5 : 365 and *Ibidem* 33 : 358, H.A., 1936, 6 : 259.

programme is intended to obtain information on compatibility with domestic varieties, tendency to deposit dry matter, ability to modify seedling roots, ability to form roots in the scion (the new stocks are rootgrafted as scions and ringwired above the union to induce rooting in the scion), ability to reproduce from root cuttings and character of regenerated roots.

835. MANEY, T. J. AND PLAGGE, H. H. 634.12-1.541.11
An unusual leaf characteristic which is useful in identifying the Virginia crab apple stock.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 305-6, bibl. 2.

Virginia crab is a stock much used in America for double working. Instances have occurred where the stock has become mixed with other types. Attention is called to the fact that in addition to the characters described in a previous paper* Virginia crab may be identified with certainty by a distinct golden coloured deposit along the main veins, caused by the accumulation of small yellow oval wax globules. The conditions under which this occurs, however, are somewhat special, namely, in the early stages of growth and under greenhouse conditions with temperatures below 60-70° F. Higher or ordinary field temperatures melt the wax and render the method of identification valueless.

836. LAGASSE, F. S. 634.11-1.542 : 631.541.11
The effect of pruning on yields of own-rooted and seedling rooted apple trees.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 319-22, bibl. 3.

The trees are 8 years old. The varieties are not stated. The trees were on their own roots or on French crab. They were winter pruned each year, except 1933, to a semi-leader type of tree, with no heading back of new growth except of wayward branches. Pruning seriously changed the normal behaviour of the trees, decreasing yield and increasing variability. *Unpruned* trees on seedling crab have yielded more fruit to date than unpruned own-rooted trees and have shown less variability in yield. In the *pruned* trees own-rooted trees outyielded and were less variable than those on seedling crab stock. It is suggested that for nutritional studies on young trees over a period of years, where yield is concerned, no pruning should be given.

837. VAN CAUWENBERGHE, E. 634.22-1.541.11
Selection et identification des pruniers employés comme porte-greffes pour la culture du prunier et du pêcher. (Selection and identification of plum rootstocks for plum and peach.)

Fruit belge, 1937, 5 : 31-6, 49-54, 61-5.

Nearly as much confusion exists between the various plum rootstocks as formerly existed among the apples. The same variety may be sold under different names according to locality and even then will probably be mixed, while information concerning their growth habits, their influence on the scion and their soil preferences is scant and uncertain. An alphabetical list of 14 plum stocks in common use is given. From this list are formed 2 categories, the first containing varieties which are usually propagated vegetatively, the second those which at present are commonly raised from seed (most of them can be propagated vegetatively). The morphological and physiological characters are then described for the more important stocks, with information on the cultural results observed and on methods of vegetative propagation which have proved successful (not necessarily on a commercial scale). In a rough estimation of the stock influence, St. Julien A is classed as of moderate vigour, Damas C vigorous and Brompton as very vigorous. Stock influence appears to be less pronounced than with apples, but stock/scion incompatibility is more frequent. The less vigorous scion varieties are the most influenced by a vigorous stock variety. Peach on broad-leaved mussel has possibilities. Peach on plum usually flowers later than peach on seedling peach.

* Maney, T. J., *Ibidem* 1934, 32 : 330.

Rootgrowth.

838. SCHUSTER, C. E. 581.144.2 : 634.1/7-1.4

Root development of trees as affected by physical properties of the soils.

Proc. 32nd annu. Meeting Wash. St. hort. Ass. 1936, 1937, pp. 22-6, bibl. 4.

The data, on which the present notes were based, were obtained from unirrigated orchard soils, in the Willamette Valley in Oregon mainly under walnuts about 25 years old. Initially root growth was disclosed by trenching but later, when several trials had shown that there was little significance in the occurrence of the larger roots, the work was confined to roots of 2 mm. in diameter or less, which were the most evenly distributed and are most intimately associated with the absorption of moisture and plant food, and the use of the King soil tube was substituted for trenching. The discovery of loganberry roots at 10·5 ft. deep and filbert roots at 11·5 ft. deep indicated that most plants would send their roots deeply into the subsoil, if not prevented by such hindrances as rock, permanent water table and hardpan. Places were, however, found where few or no roots occurred for apparently no reason. The work indicates that soil layers within normal reach of tree roots with less than 5 or 7% of air space or non-capillary porosity at field moisture capacity have few or no roots. Layers with more than 10-12% and up to 30% air space have abundant roots. Soils with tight layers of 5-7% or less air space within 3·4 ft. of the surface are classed as poor soils. In some soils 90-95% of the roots are confined to the upper 36 in. of the soil profile, the remainder being distributed lower down and acting apparently as subsistence roots in case of drought. Where 10-12% or more of air space is found continuously to a depth of 10 ft., such soil based on tree growth is classed as good. In some soils of this type as many roots were found at 8 as at 3 ft.

Pollination.

839. RUDLOFF, C. F., AND SCHANDERL, H. 581.162.3 : 634.11

Befruchtungsbiologische Studien an Äpfeln. (Apple pollination studies.)
Gartenbauwiss., 1937, 11 : 251-71, bibl. 75.

Experiments on pollination carried out at Geisenheim and Müncheberg in the years 1930-1936 are here described. The character of the pollen and its germination capacity were tested in the case of 219 apple varieties, of which 36% proved good and 64% bad pollinators. The results of self- and cross-pollination tests on over 170,000 flowers on 147 varieties are set out briefly. Of 143 varieties self-pollinated for several years, 141 or 98·6% proved practically self-sterile, only two varieties, Carpentin and Weidner's Goldrenette, producing occasional seed-containing fruits after self-pollination. In Carpentin these seeds were definitely the result of self-pollination and were not apogamic in origin. As regards Weidner's Goldrenette the position is not so clear. Four new inter-sterility groups were determined as follows:—Canada Pippin×White Winter Calville, Canada Pippin×Goldpearmain, Blenheim Orange×Goldpearmain and Belle de Boskoop×Transparent de Croncels. The experiments show that a so-called good pollinator need not be a good pollinator for all other varieties. The degree of its reliability varies and must be determined for each other variety.

840. SCHANDERL, H. 634.13 : 581.162.3

Befruchtungsbiologische Studien an Birnen. (Pollination studies on pears.)
Gartenbauwiss., 1937, 11 : 297-318, bibl. 78.

Pollination studies were made during the years 1933-1936 at Geisenheim and Merten near Bonn on 198 pear varieties. Forty-one of these, or 20·7%, proved to be bad pollen producers. The results of 80,910 blossom experiments on cross- and self-pollination are here set out. Louise Bonne was found to be sterile when crossed with Williams', but this inter-sterility was less marked when the reverse cross was made. No variety can be regarded as a universally good pollinator. Bergamotte Esperen forms marketable fruit with fair regularity even without

cross-pollination, but in no other variety, even those with a tendency to parthenocarpy, has the phenomenon of parthenocarpy any practical importance. In Jeanne d'Arc the failure of the blossoms to open is characteristic. The stigmas are so hidden by the petals that no wind-borne pollen can reach them and pollination can only be accomplished by means of insects. Beurre Napoleon, even after cross-pollination, produced only seedless fruit. This is considered as a rather notable instance of parthenocarpy. In this case sufficient stimulation to set the development of the pseudo-fruit in action is given by the fertilization of the oosphere or even by the penetration of a foreign tube.

841. MURNEEK, A. E.

581.162.3 : 634.1/2

Pollination and fruit setting.

Bull. Mo. agric. Exp. Sta. 379, 1937, pp. 28.

The question of self-sterility in apples is discussed and notes are given of varieties which experience has shown to be good pollinizers. Pre-eminent among these are Delicious, Jonathan, Ben Davis and Golden Delicious. Where blocks of self-sterile varieties are already planted and bearing insufficiently, top-working every third row to good pollen varieties is recommended. Until these blossom, pollination can be ensured by the provision of bouquets of flowering branches of good pollinizers and by measures whereby the presence of bees is certain. Pollination is no use, unless adequate tree nutrition, pruning and cultivation ensure proper metabolism in the tree. Ample pollination of trees in a rather devitalized state may result in overbearing and its attendant ills, namely small, badly coloured fruits, breakage of limbs and biennial bearing. The last is perhaps the worst result, since once started there would appear to be no sovereign remedy to cure it. Briefer notes are given on varietal sterility in pears, peaches, cherries, plums, grapes and small fruits as noted in Missouri.

842. MARANI, M., AND OTHERS.

634.22-1.55

Ulteriori ricerche di orientamento sulla fertilità della varietà di pesco "Bonvicini". (Further investigations on the problem of fertility in the Bonvicini peach.)

Riv. Frutticoltura, 1937, 1 : 49-58, bibl. 2.

Previous work having shown that even in the presence of good pollinator varieties the fertility of Bonvicini remains poor, further observations were made on a number of flowers and buds, both wood and fruit, on the length of annual wood and of the interrelation of these factors. The following conclusions were reached :—1. The lack of fertility is mainly connected with insufficient fruit set. 2. To a minor degree the lack of fertility is bound up with the reduced number of fruit buds when compared with the total number of buds and with the length of the fruit-bearing branches, which are without flowers for about a third of their basal length. 3. Further work will be directed as follows :—(a) to the discovery of particularly suitable pollinators, (b) to the discovery of specially helpful cultural operations such as (1) ringing, (2) light pruning and (3) the elimination of nitrogenous organic manuring such as would tend to prevent fruit bud formation.

843. KOBAYASHI, A.

634.13 : 581.162.3

A few factors associated with the growth of fruit in selecting the pollenizer for the Chinese pear.

J. hort. Ass. Japan, 1937, 8 : 169-77, bibl. 3.

The author's experiments with several varieties of Chinese pear, although unfinished, give the following indications :—the younger the pistils after the opening of the flowers, the higher will be the rate of fruit set and the greater will be the increase in weight of the fruit ; the later the date of pollination after flower opening, the greater will be the delay in fruit growth in its earlier stages. This suggests strongly that the blossoming period of the pollenizer should be as close to that of the orchard variety as is possible.

844. BODENHEIMER, F. S., AND BEN-NERYA, A. 638.12 + 581.162.3

One-year studies on the biology of the honey-bee in Palestine.

Ann. appl. Biol., 1937, 24 : 385-403, bibl. 4.

The chief aim of the observations recorded here was to gather quantitative data on which to establish the biology of the honey-bee in Palestine for comparison with conditions in other countries. The seasonal vegetation is described. The frequency and duration of visits of bees to flowering fruit trees are recorded. The flight activity is correlated with temperature and humidity conditions. The brood distribution in the hive and its temperature is followed throughout the year and the egg production and changes in population are noted. The correlation of the data observed with environmental conditions and the analysis of swarming conditions are left for a later study.

Growth.

845. ALDRICH, W. W. 634.13 : 581.144.1 : 581.145.2

Relative efficiency of spur and shoot leaves for fruit growth of pears.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 84 : 227-32, bibl. 4.

On ringed pear limbs a unit area of shoot leaves resulted in significantly greater fruit enlargement than an equal area of spur leaves in 8 out of 10 experiments. In the other 2 cases the difference was not significant. Shoot leaves had more dry matter per unit area than spur leaves, and a gram of dry matter of shoot leaves seemed to produce from 12-29% more fruit dry matter than did an equal amount of dry matter of spur leaves. No explanation was found for this apparently greater activity of shoot leaves. [Author's summary.]

846. BOUWENS, H. 634.14 + 634.75 : 581.144.2 : 582.8

Investigations about the mycorrhiza of fruit trees especially of quince, *Cydonia vulgaris* and of strawberry plants, *Fragaria vesca*.

Zbl. Bakt., II. Abt., 1937, 97 : 34-49, bibl. 15.

The author briefly discusses the work of recent writers on the subject of mycorrhiza in fruit plants. She then describes her own experiments, the aims of which were :—to isolate the endophyte, cultivate sterile plants and by synthesis of fungus and root in pure culture to produce the phenomenon of mycorrhiza. Quince. Isolations were made from quince roots of an endophyte identified as a *Rhizoctonia* sp. It was found that after germination the young plants were best transferred to sterile tubes on filter papers and v. d. Crone B solution. Inoculation of such sterile plants with mycorrhiza caused mycorrhiza to form, the endophyte passing into the roots and forming arbuscules and vesicles there. In experiments where synthesis of sterile plants with *Rhizoctonia* took place in pure culture the fungus was found to penetrate the roots and live in the cells in "pelotons". No vesicles were found in such cases. Strawberry. It was found that strawberry plants possess endotrophic mycorrhiza having both arbuscules and vesicles. It was possible to germinate aseptic plants from seed sown directly into sterile tubes. These plants grew best on filter paper with v. d. Crone B solution. A *Rhizoctonia* was again isolated as an endophyte and inoculation of strawberry plants in soil or water culture with mycorrhiza resulted in development of mycorrhiza, the endophyte of one species being able to infect other species. In the case of synthesis of sterile plants with *Rhizoctonia* in pure culture the fungus was found to penetrate into the roots and live there in the cells in "pelotons". No vesicles were found in such cases.

847. EINSET, O. 634.11 : 581.192

Changes in hydrogen-ion concentration in the growing apple fruit.

Gartenbauwiss., 1937, 11 : 319-23, bibl. 2.

Observations were made in 1934 and 1935 on hydrogen-ion concentration and its relation to premature abscission in fruits of the following apple varieties :—Boiken, McIntosh, Milton, R.I. Greening and Rome. Samples were taken, weighed and analysed for pH concentration at

frequent intervals between mid-May and mid-October. Notes were made in the case of McIntosh on the possible effect of cross-pollination and of the time of pollination on the pH concentration. Figures on Rome trees indicate that the pH concentration may be suggestive of plant vigour. It was found that on a given tree the larger fruits have the higher pH concentration during the early stages of development, possibly because they are in a more advanced stage. When full grown they do not show the same difference. There is some indication that the stage of maximum pH reached by the end of June is followed by a slight decrease in acidity during the next month. Varietal differences exist. The first wave of fruit dropping occurs a week after full bloom. Then, depending on varieties and abundance of flowers, the shedding continues more or less uniformly until the maximum concentration is reached, i.e. about 1st July. Apparently a sudden increase in embryo development starts at this particular stage and continues until a maximum is reached. Its start coincides with the end of premature abscission.

848. BELL, H. P. 634.11 : 581.145.2

The protective layers of the apple.

Seventy-third annu. Rep. Nova Scotia Fruitgrs Ass. for 1936, 1937, pp. 71-2.

The changes in the structure of the skin of the growing apple are traced throughout the life of the fruit. At harvest time the following conditions exist. The hairs have disappeared. The cuticle or outer covering has become a continuous thick waxy layer penetrating between the epidermal cells. The epidermal cells have broadened parallel to the surface and shortened at right angles to the surface until they are thin flattened plates without vitality and usually surrounded by cuticle. The hypodermis, in May consisting of 2-4 active cells, is now made up of 4-6 layers of thick-walled cells crushed or flattened and much elongated by the growth of the fruit. The cells are vitally inactive but are filled with a dense protective deposit. These three layers together compose what is known as the apple "peel".

849. LILLELAND, O., AND BROWN, J. G. 634.21-1.542.24

Growth of the apricot fruit III. The effect of girdling.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 264-71, bibl. 6.

Girdling limbs greater than 30 mm. in diameter at the beginning of the second period resulted in a less pronounced deceleration of growth during the second and normally slow period of growth in the apricot fruit. Increasing leaf area by a very severe fruit thinning in the first period did not alter the rate of growth in the second period. The possible carbohydrate changes produced by girdling and by increasing leaf area are compared. The advanced maturity of fruit on girdled limbs and the use of girdling in early apricot shipping districts is discussed briefly. [From authors' summary.]

*Cultural practices.**

850. CULLINAN, F. P., AND WEINBERGER, J. H. 634.25-1.874

Some effects of four years of cover crops in a young peach orchard.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 242-6.

The trials were carried out on a sassafras gravelly loam and on a sandy loam soil with freshly planted Alberta and Belle trees respectively. The trees were given uniform cultural treatment during the first year after planting, consisting of a summer cover of soybeans turned under in August followed by a winter cover of rye and vetch turned under the following April. Plot treatments thereafter consisted of clean cultivation in the spring followed by summer covers of soybeans, buckwheat and crotalaria, legume sods of Korean lespedeza, *Lespedeza sericea* and biennial sweet clover; and summer cultivated plots some of which received an annual application of about 5 tons of manure. The soil over all plots was uniformly limed before the plots were established. All summer crops received a 5-8-5 fertilizer drilled in with seed and again at the autumn sowing of rye and vetches. The legume sods received the same fertilizer all in one

* See also 826, 836.

spring application. In addition nitrate of soda was also broadcast under the trees at the rate of $\frac{1}{2}$ lb. per tree rising up to 3 lb. on 3- and 4-year-old trees. Results are considered with special reference to soil moisture. On this shallow soil with a maximum water-holding capacity of 18% and a wilting percentage of 8·2% periods occurred during the trial when the soil moisture was reduced to or below the wilting percentage. The colour of the foliage on all plots was a good green and there was no evidence of nitrate deficiency in this respect, in fact the leaves of trees under sweet clover were in particular of a very dark green. There were distinct benefits visible from all cover crops in preventing erosion, in improving soil texture and in helping water penetration.

851. SHEAR, G. M. 634.11-1.542 + 632.932

Lanolin as a wound dressing for trees.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 286-8.

Removal of branches $1\frac{1}{2}$ to $1\frac{1}{2}$ in. in diameter from the lower portions of Grimes Golden apple trees was followed by treating the cut surfaces with white lead paint, lanolin, lanolin indole acetic acid and leaving untreated. Both at 3 months and 5 months the least callus growth was noticeable in the painted trees and the best in the plain lanolin treated trees. Further experiments are planned to test the effect of using lanolin with other growth promoting substances in various proportions.

Grading and marketing.

852. ROBINSON, F. E. 634.11-1.564

Re-alignment of apple grades.

Seventy-third annu. Rep. Nova Scotia Fruitgrs Ass. for 1936, 1937, pp. 64-6.

The necessity for bringing the Canadian colour grades into line with those of the U.S.A. is discussed. The Canadian regulations, especially for the barrelled grades, place the grower at a disadvantage in competition with American apples in the English market. There is under the Canadian system only one intermediate colour grade for barrelled apples, which have thus to contain apples of no red colour to those just under the colour required for first grade. It is stated that prices in the U.K. are influenced mainly by colour and that the under colour penalization due to the wide range included in the present intermediate grade may amount to 3s. to 5s. per barrel.

853. RUSSELL, R., AND LENNARTSON, R. W. 634/5 : 658.8

Marketing fruits and vegetables by motor truck in Western Maryland.

Bull. Md. agric. Exp. Sta. 407, 1936, pp. 299-375.

Records covering a year's operating costs (i.e. 1933-4) for marketing fruit and vegetables by motor truck in Western Maryland are discussed in detail. On the average growers were about 25 miles from their chief markets and the average acreage of fruit and vegetables per farm was 39·4, 29·1 and 54·0 in different parts of the area examined. Items of cost in marketing expressed as percentages of total marketing cost were :—transportation 27·2, containers 38·1, commission 16·1, storage 3·2 and selling 15·4% (selling costs included that of the time spent in marketing or waiting to market and in delivery of produce after sale). Total marketing costs for individual commodities varied with the bulkiness of the product, the value in relation to weight, the distance hauled and the cost of packing. The range was from 20·0 to 37·4% of gross value. If individual areas were considered, the range was from 8·8% of the gross value in the case of asparagus in one area to 46·7% in the case of apples in another area. Twenty types of buyers and selling agents were reported as handling the produce of the 189 growers considered. On Baltimore Marsh market, for instance, commission brokers handled 45·1% of the produce, commission merchants 20·9% and chain store buyers 8·7%.

SMALL FRUITS, VINES, NUTS.

854. ANAGNOSTOPOULOS, P. TH. 634.37-1.551
The hastening of maturity in figs by anointing with olive oil. [Greek, English summary.]
Horticultural Research, Athens, 1937, 2 : 265-70.
 Anointing young green figs with olive oil advanced maturity by 20-30 days and resulted in an improvement in the fresh/dried fruit ratio.
855. COLBY, A. S. 634.711-1.432 : 581.144.2
Preliminary report on raspberry root systems.
Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 372-6, bibl. 2.
 The distribution, concentration and differentiation of the roots of certain American raspberries were found to be influenced by the genetic constitution and age of the plant and by the moisture, nutrient supply and aeration of the soil. Summer root pruning of purple raspberries reduced the vigour of subsequent growth in proportion to the severity of the pruning. All cut roots developed crown gall, even though healed.
856. BRIERLEY, W. G. 634.711.3 : 581.11
Further studies of the absorption of water by red raspberry foliage and some evidence relative to the movement of water within the plant.
Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 385-8, bibl. 2.
 It is shown that the foliage of the red raspberry (Latham) can absorb moisture when there is a deficiency of soil moisture and that the water so absorbed moves readily within the plant either upward or downward. Ease of water movement is independent of the observed variations in the number and size of the tracheae. The conducting capacity of the individual cane is considerably in excess of its minimum requirements.
857. BRIERLEY, W. G., AND LANDON, R. H. 634.711.3 : 581.13
Some evidence relating to the downward movement of photosynthate in fruiting canes of the red raspberry.
Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 377-80, bibl. 4.
 From the studies described it is improbable that harmful competition can exist between the fruiting canes and new growth of the American red raspberries Chief and Latham. The relationship is probably a co-operative one ; that is to say that food stored in the canes and roots may be transported upwards and used to promote growth and that when the fruiting laterals have finished growth a large foliage area is forming photosynthate in excess of the needs of the fruiting canes. The surplus may be transported downwards and used or stored in other parts of the plant until translocation of sugar is prevented by the normal senescent breakdown of the phloem.
858. GREVE, E. W. 634.75 : 612.014.44
The effect of shortening the length of day on flower bud differentiation and on the chemical composition of strawberry plants grown during the normal growing season.
Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 368-71, bibl. 4.
 A study was made of flower bud differentiation in the Howard 17 strawberry of N. America, from which it appears that the flower bud formation is directly associated with the length of day under which the plant is grown. The length of day influences the chemical composition of the plant, particularly the C/N ratio, and thus flower bud formation seems to depend upon a nutritional condition within the plant. [From author's summary.]

859. HOFFMAN, M. B. 634.75-1.543.3
Early growth of strawberry plants resulting from several methods of handling before setting.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 346-8, bibl. 2,

There is a close relationship between the leaf area of the strawberry plant and the production of berries. Maximum leaf area was developed in the Hudson Valley, New York State, in 1936 when transplanting was done early in the season, i.e. early April, and dormant plants were used.

860. CHRISTOPHER, E. P. 634.75-1.543.1
The influence of spacing strawberry plants on leaf development.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 341-5, bibl. 2.

Under the growing conditions in Rhode Island during 1936 the production of large well-developed runner plants, capable of heavy yields was markedly favoured by wide spacing round the mother plant, the finest plants being produced in ascending order by runner spacings of 8, 10, and 13 inches.

861. DARROW, G. M. 634.75 : 612.014.43/4
Interrelation of temperature and photoperiodism in the production of fruit-buds and runners in the strawberry.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 360-3, bibl. 5.

Experiments are described which confirmed previously published work indicating (a) that the rest period in the strawberry is a result of nutrient conditions caused by a short-day low growing-temperature complex, (b) that transformation of vegetative growing points into fruit buds requires shorter daily light periods at higher than at lower temperatures; (c) that varieties exhibit characteristic day length responses which in a large part determine their regional adaptation.

862. WHITEHOUSE, W. E., AND SCHRADER, A. L. 634.75-1.8
Strawberry fertilizer studies in Maryland.

Bull. Md. agric. Exp. Sta. 403, 1936, pp. 206, bibl. 41.

The soil varied in the experimental areas from loamy sand to heavy silt or clay loam. The varieties used were Missionary, Premier, Chesapeake and Gandy. Mixed fertilizers were made up by combining sodium nitrate, superphosphate and muriate of potash, except for certain plots where ammonium sulphate replaced the nitrate. Six series of plots were laid down and records were taken of blossom and berry formation, foliage, size and yield of berries. When possible Fisher's method of analysis of variance was applied to the data to arrive at probable significance of differences. The "Z" test was used to test significance. The results of different treatments are tabulated and discussed and among the conclusions reached are the following:—
 1. Early development of runners is stimulated by nitrogen applications in the spring of the 1st year. 2. If the soil is fertile enough to grow a good bed of plants, yield increases may not result from giving fertilizer at planting. 3. Late summer applications may be beneficial and preferable to applications the following spring. 4. Benefits from top dressing in the spring of the 1st fruiting year are more probable in a warm dry season than in a moister, less sunny one. 5. Top dressing in the spring of the 2nd fruiting year will increase yields. 6. In using such a readily available fertilizer as nitrate of soda care must be taken to avoid stimulating excessive foliage growth and delayed ripening of berries in early varieties. Nitrogen tends to increase size of berry and delay its maturity. Lime used in sufficient amount to satisfy the lime requirements of the soil was found to decrease yield.

863. NEGRUL, A. M. 634.8-1.523
The genetic basis of grape breeding. [Russian, English summary 7 pp.]

Publ. Lenin Acad. agric. sci. Inst. Pl. Ind. ser. 8, No. 6, Fruits and small fruits, pp. 150, bibl. 10 pp. (2 Russian).

The following notes are taken from the summary:—This paper deals with work on grape genetics with regard to breeding and taxonomy. It includes the findings of foreign workers and of

Russian workers at the following stations in recent years ;—Ukrainian Institute of Viticulture, Odessa ; the Institute of Plant Industry, Leningrad and its sub-station at Tarnau near Tashkent. *Grape hybrids.* Natural hybridization has played a most important part in the creation of the American and European vines. *Inbreeding and heterosis.* The varieties of *V. vinifera sativa* DC are heterozygous in a different degree and in some cases conceal recessive negative properties and characters. In crosses between varieties of *V. vinifera* heterosis is not usually observed. In interspecific hybrids (*V. vinifera* × *V. amurensis*, *V. vinifera* × *V. rippestris*, etc.) heterosis takes place in respect of growth but not fruit bearing. *Inheritance of the leaf.* Data are given on the variation and inheritance of shape, size and pubescence. *Inheritance of autumnal leaf colour.* Data support the monofactorial nature of this character even in interspecies crosses. *Inheritance of variegated leaves.* Three cases of chlorophyll suppression in grape vines are noted. *Variation and sex inheritance.* The data available are summed up. *Variation and inheritance of parthenocarpy.* The types of partial and obligatory parthenocarpy are surveyed. Data are given on the causes of these phenomena and on their inheritance. *Variation and inheritance of fruit properties.* Data are given on the size of the cluster and the berry, the colour, texture, flavour and taste of the berry, and on the sugar content and acidity of its juice. *Variation and inheritance of immunity.* Here the regularity in geographical distribution of phylloxera- and mildew-resistant forms is discussed. Resistance to both phylloxera and mildew is inherited. How inheritance affects resistance is considered. A further inherited factor is winter hardiness. It is suggested that the chief basic material for breeding hardy varieties should be *V. riparia* (Canada), *V. amurensis*, *V. Labrusca* and *V. vinifera silvestris* Gonol. *Correlation and inheritance of some characters and properties of grapes.* Proved genetic linkage is observable in grape vines only in respect of sex characters. *Genetic confirmation of some findings of taxonomy and the problem of the origin of cultivated grapes.* The theory is advanced of the monophyletic origin of all species of the genus *Vitis* and an estimate is made of the properties probably possessed by the unknown progenitor, all of them being those possessed in common by the American, European and Asiatic groups. *Genetic basis of grape breeding.* Practical hints are given for the application of the lessons learnt from the author's investigations and deductions.

864. STOUT, A. B. 634.873 : 581.145.2

Seedlessness in grapes.

Tech. Bull. N. York agric. Exp. Sta. 238, 1936, pp. 68, bibl. 44.

The writer deals in considerable detail with the phenomenon of seedlessness in grapes and the anatomical features of seedless and seeded berries. He considers the development of fruit and seeds in such seedless grapes as Sultanina and Black Monukka and notes the development in seedlings obtained when breeding for seedlessness. He notes the progress made in breeding new seedless grapes in New York State.

865. FLEMION, F. 634.8 : 581.142

After-ripening at 5° C. favors germination of grape seeds.

Contr. Boyce Thompson Inst., 1937, 9 : 7-15, bibl. 6.

The optimum germination results with grape seeds in U.S.A. were obtained with seeds held in moist peat moss at 5° C. for from 3-4½ months and then planted in a warm atmosphere. Removing part of the seed coat reduced germination probably through injury to the radicle. The varieties used were *Vitis aestivalis*, *V. bicolor* and the varieties Concord and Delaware.

866. YATOMI, Y., AND HARAKO, H. 634.8-1.542.27

Observations on the setting of berries with *Vitis vinifera* influenced by flower cluster pinching. [In English.]

J. hort. Ass. Japan, 1937, 8 : 193-6, bibl. 6.

Flower cluster removal just before blossoming resulted in successful berry set in grape varieties such as Cannon Hall Muscat and Kôshû-Sanjaku. The result is attributed to the increased

nutrients thereby made available to the remaining parts by the removal of cluster tips. The main stems of treated branches were much sturdier and healthier than those of the untreated clusters. A subsidiary "shoulder" growth of treated bunches was also noticeable.

867. DOTTI, F. 634.8-1.542

Influenza della potatura della chioma e della radice prima del trapianto sullo sviluppo della vite. Ulteriori ricerche. (The effect on the growth of the vine of root and ordinary pruning at the time of transplanting. Further investigations.)

Riv. Frutticoltura, 1937, 1 : 147-62.

The author's investigations on pruning the root and top of vines at transplanting already reported in 1936 (see *H.A.*, 1937, 7 : 57), have been taken a step further. The experiments here reported were made on the following vines:—Berlandieri × Riparia growing in the plain, ditto in the mountains, Berlandieri × Riparia 420A growing in the mountains and Sangiovese worked on 420A growing on the hillside. The number of individual vines used were 484 rooted cuttings and 84 rooted cuttings grafted with Sangiovese. On the whole the conclusions reached confirm those drawn by the same author on previous occasions. They are as follows:—In all cases removal without disturbance of roots and replanting with roots as far as possible in the same position as before resulted in the quickest recovery from transplanting and the greatest increase in growth. When the planting is done in autumn with well rooted vines, drastic top pruning depresses increased growth: no top pruning at all is preferable. If top pruning is restricted to about 20 to 30% with the aim of balancing the loss of roots inevitable at uprooting, its effect may be favourable rather than unfavourable. If for any reason it is necessary to reduce the root apparatus, a similar reduction should be made in the top. Other conditions being equal, and apart from the better growth increase which one gets from unpruned vines planted in autumn, if planting is done in spring, top pruning may be considerably more drastic. In general in spring plantings, top pruning at the moment of transplanting may amount to one-half of the top in the case of vines uprooted with great care. In every case it would seem expedient never to reduce the top to a minimum of less than 5 or 6 buds, even if the vine in question is poorly rooted. Top pruning on such a scale helps the vine to recover from the shock, especially if the planting is done in spring. Root pruning alone is always harmful. Drastic top pruning only partially balances a similarly drastic root pruning. It may help the plant to recover but the effect on increased growth is small. European varieties bench grafted on American stocks and after a year in the nursery seem to be much less sensitive to harm arising from root pruning than unworked American stocks. Even in the case of spring plantings careful uprooting coupled with the absence of any root pruning helps in the recovery of vines and in vegetative growth in the first year of planting.

868. FINCH, A. H., AND VAN HORN, C. W. 634.521 : 581.145

The physiology and control of pecan nut filling and maturity.

Tech. Bull. Ariz. agric. Exp. Sta. 62, 1936, pp. 472, bibl. 47.

Inadequate nut filling presents a serious problem to the pecan grower. The authors discuss previous work on the subject and note how it has been found possible to influence the oil content of various seeds by manipulating conditions which affect carbohydrate synthesis and storage. Experiments here described were undertaken to determine the effects of different nutritional conditions on the vegetative condition of pecan trees and on the degree of filling achieved by the nuts. The data obtained are set out very fully. They show that nut filling, quality and maturity are dependent upon maximum storage of fats in the nut, which in turn depends on the presence of available carbohydrates. Cultural treatments tending to produce a condition of moderate or low vegetativeness provide for most abundant carbohydrate storage and hence for best nut filling. The following suggestions are made:—*Irrigation.* After harvest, in the winter, spring and early summer, abundant soil moisture is essential, but in late summer and autumn irrigation will reduce the storage of carbohydrates and should be used very sparingly. *Cultivation.* Excessive cultivations may reduce blossoming the following year. Where possible, only one

light cultivation should be given in September. *Cover cropping*. The effect of such crops is to reduce vegetativeness, but they should be used with caution. *Manuring*. It is safest to apply no fertilizer to bearing groves in the summer. The application of N and P fertilizers during the winter should increase blossoming and set the following year. *Sunlight*. Trees should be so trained when young that the maximum number of leaves is exposed to the sun. *Variety*. High carbohydrate varieties which naturally present well filled kernels will produce good nuts under a wide range of conditions. The low-carbohydrate varieties are best adapted to heavy soils. Heavy soils retard vegetativeness in pecans, whereas soft loamy soils improve it. The pecan grower is faced with the problem on the one hand of stimulating vegetativeness to make the trees blossom and bear satisfactorily, and on the other hand of retarding vegetativeness to produce better filled nuts. He has to be continually on the watch and should allow the cultural needs of his trees to be decided by the condition of vegetativeness displayed by them.

PLANT PROTECTION OF DECIDUOUS FRUITS.*

869. DUNN, S. 632.111
Factors affecting cold resistance in plants.
Plant Physiol., 1937, 12 : 519-26, bibl. 12.
 Attempts were made to eliminate the individual variations in hardiness and to increase the average resistance to cold of certain herbaceous plants by varying some of the environmental conditions and by vegetative propagation of survivors of lengthy exposure to cold. No success was obtained with cabbage grown under different constant soil moisture levels or provided with high or low amounts of the principal nutrients. A greater average survival from freezing was obtained with potato and cabbage grown under a cool temperature than with those grown at a warm temperature, but this did not eliminate individual variations within the group. The vegetative propagation of survivors to cold exposure of *Bryophyllum* and Jerusalem artichoke resulted in an average increased cold resistance for such groups for 3 generations after which resistance faded and reversion to the original status had been reached by the 6th generation (earlier with Jerusalem artichokes).
870. LEONOFF, I. M. 634.11-2.111 : 581.14
An experiment in applying biometrical analysis of the apple tree under Siberian conditions. [Russian, English summary 1 p.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 1, pp. 64-70, bibl. 8 (Russian).
 The experiment has been in progress for many years and results are based on data received from the Krashoyarsk Research Station and the Minussinsk Experimental Fruit and Berry Cultures Field. The following notes are taken from the summary:—The earlier the growing season of any apple variety begins under any combination of climatic factors, the more frost resistant is the variety. The frost resistance of a variety decreases as the beginning of its vegetative growth deviates from the time at which growth becomes possible in a given locality, and the greater the delay in starting into growth after that date, the less frost resistant the variety. Early or late completion of the growing period does not always show any influence on the frost resistance of a variety. Early flowering varieties possess a more frost resistant wood, late flowering ones are less cold resistant. The more pronounced the pubescence of the leaves, the later is the beginning of the growing period and the less the frost resistance of a variety, but the larger the fruit and vice versa. The date of commencement of the growing period affords a useful indication of the size of fruit. Varieties which start into growth early have smaller fruit and those starting late are large fruited. The age of a variety only slightly affects the determination of the degree of frost resistance. The degree of frost resistance and the size of the fruit can be determined by noticing the time of the beginning of the growing period both in grafted and in seedling plants.

* See also 831.

871. SCARTH, G. W., AND LEVITT, J. 632.111 : 576.3
The frost hardening mechanism of plant cells.
Plant Physiol., 1937, 12 : 51-78, bibl. 48.
 Cell changes in hardening are reviewed and the features of hardened and unhardened cells are compared. The press juice of hardened cabbage shows a precipitation of colloids over a wider zone in the pH scale, a slightly lower H-ion concentration, and an unchanged buffering capacity. Artificial change in the H-ion concentration of the sap in life does not affect hardness (in cabbage). The most pronounced changes in the protoplasm of hardened plants are increased permeability and lowered viscosity; in the vacuole increased osmotic pressure and (in trees) non-solvent space. The ways in which these may protect the cells against mechanical injury from frost are discussed.
872. KRAMER, P. J. 632.111 : 612.014.44
Photoperiodic stimulation of growth by artificial light as a cause of winter killing.
Plant Physiol., 1937, 12 : 881-3, bibl. 4.
 Failure of *Abelia* to cease growth before winter on account of photoperiodic stimulation by electric light is clearly indicated as a cause of subsequent death from cold. The importance of the photoperiodic reaction in determining the degree of cold resistance of some woody plants is pointed out. The winter killing of isolated trees and shrubs in proximity to electric lights has often been noted and is probably due to this failure to cease growth in time.
873. DUNN, S. 632.111 : 581.111
Value of the dye-adsorption test for predetermining the degree of hardiness.
Plant Physiol., 1937, 12 : 869-74, bibl. 4.
 The dye-adsorption test, involving colorimetric measurement of colloid content of plant tissues, when used as a measure of cold hardiness proved of doubtful reliability in the case of *Bryophyllum* and cabbage. Every other method for testing hardiness so far reported in the literature has proved equally ineffective. As a test of average hardiness of a large group of plants the method possesses a certain limited degree of effectiveness.
874. OVERLEY, F. L., AND OVERHOLSER, E. L. 632.111 : 634.1/2
Low temperature injury of fruit trees in Central Washington during 1935-1936.
Proc. 32nd annu. Meeting Wash. St. hort. Ass. 1936, 1937, pp. 147-52.
 The injury during the 1935-1936 winter was confined entirely to parts of the tree above ground. *Trunk injury.* This was mainly on young trees from 3 to 10 years old. It varied from slight discoloration of the cambial region to complete girdling of the tree by death of bark and newer sap wood. In many cases the bark cracked and separated from the sap wood. When the injury was not too severe, tacking the bark down was sometimes sufficient to allow the bark splits to callus over. Other treatments were:—bridge grafting which was successful in the case of slight injury on only one side of the tree; leaving entirely alone and trusting to the formation of enough growth by new sprouts from below the injury to bridge graft later; cutting off below the injury and crown grafting. The last method was only partially successful owing to injury existing below the point of cutting or to excessive shoot growth of the new scions which resulted in them breaking out or succumbing to aphis attack. *Crotch injury.* The areas killed varied from those at the base of the large main branches in the crotches, to well up on the inner side of the upright branches. When girdling resulted, the girdled portions generally died by the next autumn. When only partial girdling occurred the branches often recovered. *Bud and twig injury.* Most of the fruit bud injury occurred at the higher altitudes. In the lower valleys leaf buds showed more injury than fruit buds. With some varieties where the fruit was frozen on the trees the spurs and buds near the spurs bearing the frozen apples were killed. When all the fruit had been harvested a week or more previously the spurs and buds were uninjured. *Pruning.* It is recommended that in districts liable to really low temperatures pruning should

be delayed until the worst cold is over. Trees from which fruit had been harvested some considerable time before autumn low temperatures were experienced fared better than bearing apples. Apples suffered worse, generally speaking, than pears, cherries or peaches.

875. BRADFORD, F. C. 632.111 : 634.1/7

Three distinct types of winter injury in trunks of fruit trees.

Quart. Bull. Mich. agric. Exp. Sta., 1937, 19 : 179-82.

1. Sun scald or south-west injury. A strip of bark of varying width and length is killed, usually on the south-west side, when a sunny day is succeeded by a cold night. The immediate cause of death is freezing, but the heating of the bark is an antecedent cause. These wounds heal only from the side; dead bark should be removed and an antiseptic dressing applied. 2. Bark cracking is commonly, though possibly incompletely, explained as due to a rapid fall of temperature following a warm period causing a contraction in the outer annual rings while the interior of the trunk remains expanded. Recovery is prompt without treatment, but a recurrence of the injury at the same spot is frequent. 3. Bark separation in which the bark splits and rolls back from the trunk is apparently caused by an accumulation of water (sap) between bark and wood in such quantities as to cause a mechanical rupture on freezing. The injury is most prevalent on heavy, moist soils. Healing may proceed naturally but will be greatly accelerated if the protruding bark flaps are nailed or tied back in place.

876. CLARK, J. H. 634.8-2.111

Injury to the buds of grape varieties caused by low temperatures.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 408-13, bibl. 5.

A temperature of -4° F. caused considerable injury to the buds of many varieties of grape vines without, however, greatly affecting yield, even when 33% of the primary buds were killed. The primary bud is more susceptible to low temperature injury than secondary or tertiary buds. The wood of the grape vine is more resistant than the bud. A classification is given according to the percentage of primary buds alive after minimum temperatures of -16° , -14° and -4° F. There is great variation in bud hardiness of varieties within a given species.

877. MARANI, M., AND OTHERS. 634.25-2.111

Osservazioni sulla "cascola" delle gemme da frutto nel pesco. (**Observations on fruit bud fall in peaches.**)

Riv. Frutticoltura, 1937, 1 : 89-96, bibl. 8.

Observations on prefloral fruit bud fall in peaches were carried out at Ravenna in the spring of 1937. The most forward varieties suffered most severely. The preceding winter was rather mild and there was certainly no cold severe enough to kill dormant fruit buds. Minimum day temperatures in January were fairly low, the thermometer dropping to just below 20° F. on the 11th and 12th, and maximum temperatures were fairly high. The beginning of February was very mild, the minimum on the 6th being 41° F. and the maximum 57° F. This was followed by some rather cold days, the minima on the 15th and the 16th and 17th being 22° F. and 25° F. and 25° F. respectively. The result was a fall of fruit buds varying from 14.99% in Hale's Early, which was not very forward, to 25.7% in Bonvicini, a much more precocious variety. This was due to the effect of cold on the already moving buds.

878. DAVIS, M. B. 634.11-1.8 : 632.19

Orchard problems.

Seventy-third annu. Rep. Nova Scotia Fruitgrs Ass. for 1936, 1937, pp. 66-8.

The problems dealt with are troubles due to faulty fertilizer practices and to remediable soil difficulties. Certain of these troubles are rapidly on the increase in Canada. Disorders due to a lack of balance in the major elements are first mentioned. Leaf scorch signifies a low potash level compared with nitrogen and can be rectified by increasing the one or decreasing the other.

Waterlogged soil conditions, by destroying the lower roots, reduce the accessibility of the potassium supply which is largely gathered in the lower soil areas. Bronzing and/or purpling of the leaf signifies deficient phosphorus. The mistakes many growers make in their fertilizer programmes are briefly discussed and recommendations made for combating various conditions. Physiological disorders due to lack of such minor elements as boron, manganese and iron are discussed. Drought spot, corky core and internal cork are results of boron deficiency and differ in this respect from bitter pit and blotchy cork. The distinguishing characteristics are described. The boron deficiency group can be corrected by soil applications in spring of 4-8 oz. of borax per tree on soils which are not highly alkaline. On alkaline soils the borax should be incorporated in 2 applications of lime-sulphur spray, i.e. the calyx spray and the next but one following, at the rate of $2\frac{1}{2}$ lb. per 100 gall. Injection is not recommended on the grounds of possible tree damage and impermanence of results. Bitter pit and blotchy cork (the latter merely a development of the first) are associated with high nitrogen conditions accompanied by leaf scorch or excessive growth vigour. In either case cures have been effected by increasing the supply of minerals. Iron and manganese deficiencies are at present of small importance and are signalized by a chlorotic condition. They may be due to a soil deficiency in the mineral concerned or to its being rendered unavailable by excessive lime. In either case the remedy is an application of the deficient mineral. The paper concludes with a synopsis of the symptoms whereby the various deficiencies may be diagnosed.

879. . WEINBERGER, J. H., AND CULLINAN, F. P.

634.25-2.19

Symptoms of some mineral deficiencies in one-year Elberta trees.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 249-54, bibl. 5.

The experiments recorded here were made on graded nursery trees budded with Elberta peaches and planted in sand in 3-gallon earthenware crocks which received a complete nutrient solution less particular elements. Some of the effects of omitting such elements were as follows:—
Nitrogen. Three weeks after omission growth stopped and leaves paled and later became reddish and distorted. Defoliation was early. Relatively 3 times as much fibrous root formation occurred in proportion to top as in complete nutrient trees. *Phosphorus.* Growth stopped early but was almost as great as in complete nutrient trees. No marked disorder occurred. *Potassium.* Length growth was little changed but internodes were much longer and branch diameters much less than in the controls. A chlorosis appeared quite early resembling that caused by iron deficiency. The most marked symptom was the leaf scorch developed when cells in the extreme margin of the blades browned and died. On some older leaves not so affected a chlorosis occurred. A yellow chlorosis was noticeable from the edge to a line half-way to the midrib. Root growth was small in comparison with top growth. *Calcium.* Internodes were relatively short and hence foliage dense. Late in the season a large chlorotic area developed in the centre of the younger leaves and breakdown occurred there. About $\frac{1}{3}$ of each lamina died and the leaf fell off. Many roots died, but it was found that trees had actually a larger proportion of roots to top than the complete nutrient trees. *Magnesium.* A general chlorosis followed by defoliation appeared 10 weeks after the elimination of magnesium from the culture solution. Roots were small and scarce but apparently healthy and actively growing. *Iron.* A chlorosis occurred similar to that due to magnesium elimination. When defoliation occurred the younger leaves were lost first as contrasted with the dropping off of the older leaves in the case of no magnesium. Roots appeared to be normally healthy and abundant. *Sulphur.* Terminal growth ceased early and the newer leaves turned pale green. Small laterals developed near the tip of the terminal, having many small pale leaves and giving a rosette appearance. These leaves gradually scorched and withered. Defoliation was not evident. The roots were very distinctive being fine and numerous and of a very light distinct shade of brown. *Manganese.* The effect of this deficiency was slow and only late in the trial did the tips appear to be stunted. The leaves also assumed a dull yellowish green colour unlike any other chlorotic effects noted in other deficiencies. Roots were apparently normal. *Boron.* The effect was rapid. A dark green water soaked spot, exuding sap, appeared about 1 inch from the end of every growing tip. This spot enlarged, became necrotic and girdled the growing point. The leaves beyond the

area wilted and died. The tip also dried up. Lateral buds after emergence became similarly affected. Defoliation was early. The bark developed corky growths. The roots, mainly fibrous, were very poorly developed. *Copper* and *zinc*. No effect was noticeable.

880. HOAGLAND, D. R., AND OTHERS. 634.1/7-2.19 : 546.47
Little-leaf or rosette of fruit trees. VI. Further experiments bearing on the cause of the disease.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 210-2.

Sterilizing the soil both in an autoclave and chemically with formaldehyde or ether made it possible to grow healthy maize plants in a previously disease producing soil. Further, the addition to this sterilized soil of very small quantities of unsterilized "diseased" soil (i.e. 1 or 2 per cent.) re-established the toxic conditions which again could be overcome by suitable additions of zinc sulphate to the soil. In other experiments, unrepeated as yet, apricot seedlings and maize plants were grown in tanks of the "little-leaf" soil between lucerne plants which had been established about a year. The growth of the apricot and maize plants was retarded when compared with that occurring in soil treated with zinc sulphate, but the "little-leaf" symptoms were almost entirely absent. In another experiment in which two successive maize crops were grown large applications of urea resulted in disease free crops. Again following the decomposition in the soil of the roots of a tomato crop two successive maize crops were grown free from disease symptoms. Finally attention is called to the great influence which light and temperature have on the effects produced on plants both by the soil and by solutions deficient in zinc. It is noted that P. A. Stout has evolved a successful method for determining zinc in plant tissues based on a separation with dithiocarbazone reagent followed by zinc estimation by the polarograph. While recent experimental data indicate that zinc deficiency is an immediate cause of little-leaf, they do afford evidence that in some, if not all, cases soil micro-organisms may intervene to bring about the zinc deficiency in the plant.

881. ARK, P. A. 634.1/7-2.19
Little-leaf or rosette of fruit trees. VII. Soil microflora and little-leaf or rosette disease.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 216-21.

Recent examination of "little-leaf" soil showed water extracts of it to be toxic to detached apple shoots. Moreover the alcoholic and ether extracts of it were found to injure maize plants grown in complete culture solutions. This effect was corrected by the addition of zinc to the solution or to the plant. Sterilization of such soils by steam, by formalin or by ether destroyed the toxicity and enabled healthy plants of cotton, tomato, sunflower and maize to be grown. Trials were also made with cultures of bacteria from soils of affected areas. When some of these were inoculated into soil or sand cultures, seedlings of walnut and peach grown in the medium showed symptoms very similar to those of little-leaf in the field. The appearance of these symptoms was preventable by the presence of zinc.

882. MAGNESS, J. R., AND OTHERS. 546.27 : 634.11-2.19
Effect of nutritional treatments on internal cork of apples.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 206-9, bibl. 3.

The experimental material was a block of 30-year-old Ben Davis trees growing in a soil classified as Frankstown gravelly silt loam, from which erosion had removed most of the surface horizon. The trees had been well fertilized with nitrogen. The pH of the surface soil was about 7.2 while that of the "B" horizon was about 6.9, figures which indicate rather heavy liming, the soils being naturally fairly acid. Treatments given were:—O, $MgSO_4$ 5 lb. per tree, $MnSO_4$ 1 lb. per tree, 5-8-5 NPK fertilizer 10 lb. per tree, $ZnSO_4$ 5 lb. per tree and H_3BO_3 1 lb. per tree, all the above applied to the soil. In addition 3 g. fine crystals of boric acid were inserted in the young xylem of certain trees through 3 holes. The plots receiving boric acid, whether injected or via the soil, showed least development of cork. At the same time the complete fertilizer and the zinc sulphate plots were also almost equally free from cork, while the others were much more

severely affected. The NPK fertilizer used has not been completely analysed and it is just possible it may have contained boron. In the case of the $ZnSO_4$ soil acidity appeared to be affected in the "B" horizon and this may have affected boron availability. At the same time zinc deficiency is also a possibility of these plots.

883. McLARTY, H. R., AND OTHERS. 634.11-2.19 : 546.27

The control of drought spot and corky core of the apple in British Columbia.

Proc. 32nd annu. Meeting Wash. St. hort. Ass. 1936, 1937, pp. 142-6.

This paper contains a brief outline of the investigations conducted in British Columbia into the cause and control of drought spot, corky core and related disorders of the apple. Among the field results achieved are the following:—Withholding water increased the incidence, especially of corky core. Excess of water increased the incidence, especially of drought spot. Improving soil moisture conditions did not effect a cure. Nitrogenous manuring increased the disease symptoms in orchards subject to the trouble. Heavy potash manuring in some cases materially lessened the disease. Phosphatic manuring had no apparent result. Chemicals containing boron effected a complete cure, whether injected into the tree trunks, sprayed on the leaves or applied to the soil. Control by injection continues to give complete satisfaction as regards the cure of the two troubles, but it is considered that it entails danger of bark burning at the point of injection and cannot, therefore, be recommended for general use. Spraying boric acid on to the trees also gives excellent control, but has also caused some foliage injury. Present recommendations are to apply boric acid to the soil around the affected and neighbouring trees at the rate of 30 lb. per acre. Applications should cover the area from two to three feet from the trunk out to the outermost spread of the branches and should be made in the autumn. Boric acid is recommended in preference to borax owing to the possibility of injury from the sodium contained in the latter.

884. JOHNSON, J. C., AND DELONG, W. A. 634.11 : 581.192 : 546.27

Boron content of apples at different stages of development.

Plant Physiol., 1937, 12 : 219-20.

The data examined indicate a progressive increase in the boron content of the healthy apple fruit throughout the season. During the early and rapid growth of the fruit the rate of accumulation is relatively rapid, slowing down after June but continuing until harvest. In terms of parts per million of dry weight tissue, however, the boron content shows a fairly rapid decrease during June and July, thereafter remaining fairly constant. The apparent importance of boron during the period of rapid fruit growth is noted.

885. DELONG, W. A. 634.11-2.19 : 546.27

Calcium and boron contents of the apple fruit as related to the incidence of blotchy cork.

Plant Physiol., 1937, 12 : 553-6, bibl. 4.

Analysis of comparable samples of Stark apple visibly affected and apparently unaffected with blotchy cork failed to support the hypothesis that blotchy cork is a result of boron deficiency or to indicate that the boron and calcium contents are closely related. Previous findings that blotchy cork is associated with relatively low calcium content of fruit were confirmed.

886. PROEBSTING, E. L. 634.22-2.112

"Kelsey spot" of plums in California.**

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 272-4, bibl. 1.

Observations have shown that Kelsey spot is due to excessively high internal fruit temperatures. Under conditions in the interior valleys and foothills of California where irrigation can be practised the growing of summer cover crops appreciably checks excessive rise in air temperature under and around the trees and so the incidence of the disorder.

* See also *H.A.*, 1937, 7 : 320.

887. JOESSEL, P.-H., AND OTHERS. 634.1/2-2.191 : 581.111
 Trois années d'essais de traitements contre la chlorose des arbres fruitiers.
 (Three years' trials of treatments for the control of chlorosis in fruit trees.)
Ann. Épiphyl., 1937, 3 : 231-47, bibl. 32.
 The chief methods of chlorosis control tried during the years 1934-1936 were as follows:—application of different substances to the soil at the foot of the affected trees; spraying during growth with weak solutions (designated as Gris' method); painting pruning surfaces with a concentrated solution (Rassiguier's method) or spraying in winter with the same solution; introduction of iron salts into holes made for the purpose in trunks or branches (designated as Mokrzecki's method) or the injection of a solution of sulphate of iron (designated as Fron's method) or of pyrophosphate of iron (Rivière and Bailhache's method). The following notes give the gist of the conclusions reached:—While some substances have had no effect, others have led to the recovery of the green colour with or without damage to tissue near the point of application and drying up of twigs, branches, fruits. The use of several iron salts, particularly of the double sesquitartrate of iron and potassium (exact formula not given), iron pyrophosphate and sesquioxalate of iron and ammonium resulted in recovery of colour in chlorotic pears and peaches and the maintenance for a certain time of their productive capacity. The application of these salts by direct introduction or by painting the pruning wounds with a concentrated solution can, despite the consequent desiccation of certain fruits and branches, be repeated without danger to the vitality of the trees. The cost of such operations is very small. Direct introduction, the effect of which may last for several years, gives more noticeable and lasting results than painting and particularly than spraying during growth. Each method has its uses. Thus on lightly affected trees, or immediately before picking, in order to avoid loss of fruits, Gris' method (*see above*) using double sulphate of iron and ammonia ($\text{SO}_4\text{FeSO}_4(\text{NH}_4)_2\cdot 6\text{H}_2\text{O}$) may prove very useful. But in all other cases, except perhaps that of very young trees when Rassiguier's method may be preferable, Mokrzecki's method is recommended. These two methods may, of course, also be used simultaneously on the same tree. Since the recovery of the green colour is due to the addition of iron, the nature of the soil scarcely seems to influence the efficacy of the different salts. What preference ought to be given to one of the three substances which have shown themselves most efficacious, namely, double tartrate of iron and potassium, iron pyrophosphate, and double sesquioxalate of iron and ammonium, must depend on the particular needs of the tree in question for one or other elements, and this can be determined either by a chemical analysis of the soil or preferably by one of the methods described by Roach. It seems probable that chlorosis may become quite amenable to treatment by the selection and application by one of these methods of iron and any other salts found necessary. The amount to be applied at any one time must depend on the size of the trees. As a rough guide the authors have used doses corresponding to 1 g. iron per tree on peaches 8-12 years old, corresponding to $\frac{1}{2}$ g. for 6-8-year-old trees and $\frac{1}{3}$ g. for 3-6-year-old trees.
888. BAILEY, J. S. 634.73-2.191
A chlorosis of cultivated blueberries.
Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 395-6, bibl. 2.
 A chlorosis of cultivated blueberries in U.S.A. was dispelled by an application of ammonium sulphate. Recovery required a year. Only 4 plants were treated, of which 3 recovered.
889. RAVIKOVITCH, S., AND BIDNER, N. 634.8-2.19-1.453
The deterioration of grape-vines in saline soils.
Emp. J. exp. Agric., 1937, 5 : 197-203, bibl. 2.
 The deterioration and death of many vines of the varieties Chasselas and Muscat Hamburg is attributed to the presence of high concentrations of chlorine, as sodium chloride, in the clay soil of the vineyard of Beth-Alpha, Palestine. No signs of deterioration appeared until the vines were about 6 years old, when excessive leaf shedding and failure of the grapes to grow and ripen

was observed. At harvest the affected vines shed their leaves completely, the branches dried up and the fruit shrivelled. The damage is here well illustrated by photographs. The chemical and mechanical condition of the soil and the contents of water-soluble salts and the chlorine in the irrigated and non-irrigated soils were recorded and analysis made of the chemical composition of the fruit and leaves of the vines in various stages of deterioration. The percentage of sodium chloride in the grapes varied from 0·15 (healthy Muscat Hamburg) to 2·47 (heavily deteriorated Chasselas) and that of chlorine in the leaves varied from 0·04 to 3·35 respectively. In the fruit with progressive deterioration the glucose diminished and the acids increased, the maxima being 80·8% for glucose and 5·6% for acids.

890. LEDEBOER, M., AND RIETSEMA, I. 634.723.1 : 581.162.3
A case of unfruitfulness in black currants.

J. Pomol., 1937, 15 : 191-204, bibl. 20.

The authors working in Belgium have investigated the heavy drop of fruit which occurs within a week or two of flowering and is known as "running off" or "coulure" in a variety of black currant known as Lee's Prolific (not the Lee's Prolific known in England). They find that the variety is very self-unfruitful and is not very productive even when crossed. They have proved that the defect is unconnected with such soil factors as abnormal pH, insufficient nutrition and drought, with reversion, spring frosts or high temperature, and that protection against fungi does not prevent it. Polyploidy, moreover, was not detected. The pollen tubes were found to reach the ovary successfully and degeneration of embryos did not occur. The cause of failure appeared to lie in the failure of the pollen tube to penetrate into the ovule or the failure of the male and female nuclei to fuse. A reasonable set can only be assured by interplanting with Goliath or other suitable variety.

891. BODE, H. R. 632.8 : 634.8
 Ueber die Entwicklungsgeschichte der intracellulären Stäbe im Cambium.
 Ein Beitrag zum Problem der Reisigkrankheit des Weinstocks. (**How intra-cellular rods in the cambium develop. A contribution on the problem of the "Reisig" disease of vines.**)

Gartenbauwiss., 1937, 11 : 272-88, bibl. 27.

An account is given of the development of intracellular rods (or bars of Sanio) in the cambium of vines. The work has led to the following conclusions:—(1) The primary rods arise during mitosis and the subsequent formation of cell walls. (2) This results in a changed metabolism in the strands of the kinoplasm or in parts of the nuclear spindle and thus to the formation of rods. (3) In fully formed rods their position corresponds, with but little deviation, with that of the axis of the spindle of the cells in its early stage. (4) A cambium in which the formation of rods takes place frequently shows degeneration of individual daughter cells after mitosis. This is not infrequently followed by the absorption of this degenerated tissue or parts of it into the mass of the primary rods. (5) No particular intracellular excretion bodies (as described by Petri) necessarily correlated with rod formation could be seen. (6) Rod formation amounts therefore to an abnormal degeneration of nuclear and cell divisional development.

892. SCHWARTZE, C. D., AND HUBER, G. A. 634.711-2.8 : 632.753
Aphis resistance in breeding mosaic-escaping red raspberries.

Science, 1937, 86 : 158-9.

Experiments carried out in the Puyallup Valley of Western Washington show that certain varieties of red raspberry are resistant to the aphid vector *Amphorophora rubi* Kalt., and that others are susceptible, whilst one is immune. Antwerp, Herbert and Newburgh show marked resistance to the vector, whilst Lloyd proved to be immune. The susceptible varieties include

Chief, Viking and Latham. In the experiments carried out under glasshouse conditions the aphids could not maintain themselves on Lloyd George, whilst large populations were established on the more susceptible varieties.

A.M.M.

893. GARRETT, S. D. 631.46 : 632.4
The soil-borne fungus diseases of field and plantation crops. A review of existing control methods.

Emp. J. exp. Agric., 1937, 5 : 189-96, bibl. 23.

A classification of existing control measures for dealing with soil-borne fungus diseases is made as follows. 1. Methods designed to eliminate the fungus in its passive phase during the absence of host plants. 2. Methods designed to check the fungus in its active state on the underground parts of the crop. Measures against the active fungus may be subdivided into :—(a) attempts to increase resistance on the part of the host ; (b) roguing of infected plants ; (c) creation of a soil environment unfavourable to the fungus. 3. Methods designed to eliminate the dispersal of the fungus by outside agencies, such as insects, wind, etc. Each of these methods except No. 3 is discussed and examples are given of its practical application to the field and plantation crops of various countries. Among the examples cited are the control or attempted control of root disease of rubber in Malaya, of *Armillaria mellea* on tea in Nyasaland, of the root rot of sugar cane in the West Indies, of Panama disease of bananas, and others.

894. GHIILLINI, C. A. 632.48 : 634.2-1.541.11
Infezioni vasali nelle piante coltivate : la trombosi da "Verticillium" nella varietà "Prunus Davidiana". (Vascular infection in cultivated plants : thrombosis due to *Verticillium* in *Prunus Davidiana*.)

Ital. Agric., 1937, 74 : 208-10, bibl. 14.

The excellent resistance shown by *Prunus Davidiana* to alkaline and dry soils has led to its extensive use in Italy as a rootstock for stone fruit. Last year, however, in nurseries at Bologna young plants of this stock were particularly badly attacked at the collar by a fungus, which was isolated and finally identified as a *Verticillium*. In view of the damage sustained by these *P. Davidiana* plants caution is thought to be necessary in selecting this species as a rootstock.

895. JAGGER, I. C., AND SCOTT, G. W. 635.611 : 632.421.1
Development of powdery mildew resistant cantaloup No. 45.

Circ. U.S. Dep. Agric. 441, 1937, pp. 5.

The process of evolving this cantaloup, which shows great resistance to *Erysiphe cichoracearum*, took 6 years and was as follows :—A resistant plant from India was crossed with Hale Best ; an F_2 selection from this cross was backcrossed with Hale Best and finally a homozygous F_3 population from the backcross was mass selected to give "Powdery mildew resistant cantaloup No. 50". This melon, however, proved to vary in size, shape and quality. Starting with a selection from No. 50 four additional generations of selection produced No. 45. The selection from No. 50 and all later selections were made in isolated fields of strains homozygous for resistance in order to prevent natural crossing with non-resistant plants. It is noted that the U.S. Dep. Agric. has no seed for distribution, but that it is in the trade and seed can be got from trade sources.

896. WOLLENWEBER, H. W. 634.14-2.42
Der schwarze Rindenbrand der Quitte. (*Phacidiella discolor* (Mout. et Sacc.) *Potebnia* on quince.)

Angew. Bot., 1937, 19 : 131-40, bibl. 13.

An account of the incidence of *Phacidiella discolor* on more or less dead quince branches in Germany and of its culture on artificial medium. The disease has not as yet shown any tendency to become serious. Quince fruits appear to be more quickly rotted by it than apple. The rot induced in pears generally starts at the stalk end of the fruit.

897. VANIN, I. I. 632.42 : 634.11
Varietal scab susceptibility of apple trees in the Voronezh and Kursk Provinces and in the South-Eastern part of the Moscow Province. [Russian, English summary 17 ll.]
Sci. Fruitgrowing, Mitchurinsk, 1937, No. 1, pp. 71-6.
 Investigations conducted by the author in 1933-1935 in the above named districts proved that apple scab susceptibility is varietal. No immune varieties were found, though some showed a certain degree of resistance.
898. HAMILTON, J. M. 632.44 : 634.1
Recent investigations on the control of cedar-apple rust in the Hudson Valley.
Bull. N. York agric. Exp. Sta. 678, 1937, pp. 34.
 Brief reviews are given of the life histories of the apple-rust fungus (*Gymnosporangium juniperi-virginianae* Schw.), the hawthorn rust (*G. globosum* Farl.) and the quince rust (*G. classipes* C. & P.), and the results of tests of commercial control methods are discussed.
899. SAUNDERSON, W. R., AND CAIRNS, H. 632.452 : 634.726
On the control of gooseberry rust.
Ann. appl. Biol., 1937, 24 : 17-25, bibl. 4.
 The work reported here was done in Antrim. It has so far been impossible to find any varieties pronouncedly resistant to rust (*Aecidium Grossulariae* DC). Effective control was achieved by spraying with bordeaux and burgundy mixtures and by various proprietary colloidal preparations of copper and sulphur. Bordeaux and a colloidal copper preparation are recommended. Spraying is best done about 2 weeks before flowering, and 1 spray then should suffice.
900. MÜLLER, K. 632.411 : 634.8
Ein Vierteljahrhundert Bekämpfung der Reben-Peronospora (*Plasmopara viticola*). (Twenty-five years of vine mildew control.)
Angew. Bot., 1937, 19 : 110-8, bibl. 11.
 Very great success has attended the attempts to control vine mildew in Baden and the rest of Germany since a so-called incubation calendar was drawn up some 25 years ago and growers were gradually induced to spray in accordance with the recommendations made by the phytopathological service. The proper time as determined depends on temperature and on rainfall. Briefly it may be said that sufficient control is achieved in German vineyards by four applications of a copper-containing spray, the first towards the end of May (this being unnecessary in the drier regions), the next before flowering, the third immediately after flowering and the fourth about the end of June.
901. BOTTOMLEY, A. M. 634.8-2.482
Grape anthracnose.
Fmg S. Afr., 1937, 12 : 338-9.
 Anthracnose (*Elsinoe ampelina* de Bary) of grape vines is a fungus disease attacking all green parts of the vine. On the leaves irregular jagged holes are formed, on the shoots light brown depressed spots appear which spread and eventually girdle the stems, the fruit cracks and dries up. Control is most effectively undertaken when the vines are dormant. The diseased shoots are cut off and burnt, the loose bark scraped away and a fungicide applied. The most satisfactory fungicide in this case seems to be iron sulphate, 25 lb., sulphuric acid, 1 pint, water, 50 gallons. The sulphuric acid is added drop by drop, while stirring, to the water in which the iron sulphate, suspended in a muslin bag, has already been dissolved. The mixture being corrosive should be prepared in non-metal receptacles and applied with a mop. If, in spite of this treatment, the disease appears during growth, the affected parts should be removed and burnt and 2 bordeaux sprayings (4-4-50) made at 2-3 weeks interval.

902. EAST MALLING RES. STA. AND JOHN INNES HORT. INST. 632.753 : 634.11-
1.541.11

**The problems raised by the woolly aphid (*Eriosoma lanigerum*) of the apple—
a case for team research.**

Ann. appl. Biol., 1937, 24 : 169-210.

I. *Introduction*, by R. G. Hatton, pp. 169-73. Here the author explains events which led up to the work described later. The practical problem was the control of the woolly aphid in nursery and orchard. Examination of Northern Spy was followed by hybridization and selection of immune seedlings.

II. *The Northern Spy as a rootstock*, by R. G. Hatton, pp. 173-80, bibl. 9. A comparison of specially planted bush and half-standard trees of Grenadier on Spy at East Malling with similar trees on other clonal rootstocks showed that in most respects trees on Spy were found to be inferior as regards vigour, health and cropping at the end of 15 years. There is evidence that the same applies to other varieties grown in other parts of the world and that the behaviour of Spy as a stock is uncertain. Incidentally experiments in Tasmania and elsewhere show how Spy worked trees can be reinvigorated by inarching with seedling stocks.

III. *The root system of Northern Spy*, by W. S. Rogers, pp. 180-4, bibl. 2. Notes are given on the excavation of some 47 trees of Northern Spy, of comparable stocks Nos. I, II, IV and of Ivory's Double Vigour ranging from 3-17 years old. The root system of Spy was found to be distinctive in that it is usually sparse, one-sided, lacking in fibre and only tends to send down deep roots at the ends of the root system. Under conditions of root competition Spy roots grow downwards, but apparently they do not thrive under such conditions.

IV. *The control of woolly aphid*, by R. M. Greenslade, pp. 184-7, bibl. 7. After noting the obstacles to control presented by the wax secretions of the pest and by peculiarities in its life history the author deals briefly with methods which have hitherto been used. These include spraying, dusting, hand painting, trapping, fumigation, tree injection and biological control.

V. *Breeding immune rootstocks*, by M. B. Crane, pp. 188-95, bibl. 3. The author describes the hereditary behaviour of the apple in respect of immunity to this pest. A genetical analysis is made of families raised by crossing established apple varieties with a number of forms in general use as rootstocks. The crosses have been of susceptible \times susceptible, immune \times immune, susceptible \times immune, and in a few cases seedlings have been raised by selfing immune and susceptible varieties. The susceptibility or immunity of the 3,758 seedlings thus raised has been determined. Genetical immunity to attack would appear to be determined by a certain balance of factors and to be governed by a number of genes the action of which is in part complementary and in part cumulative.

VI. *Entomological technique*, by A. M. Massee, pp. 195-8, bibl. 4. The various methods tried at different times and the present routine methods of determining the resistance to the aphid of apple stocks and seedlings are described. In 1925 only 100 seedlings could be tested in one season. Now about 1,000 can be adequately tested annually.

VII. *Pomological selection of the new rootstocks*, by H. M. Tydeman, pp. 199-205. Notes are given on the methods whereby seedlings found to be immune are tested as to their suitability for use as apple rootstocks. Preliminary propagation tests are described. Data of the growth of Lane's Prince Albert on three selected immune seedlings are given and compared. Differences in disease susceptibility between the trees on the three stocks are shown to exist.

VIII. *Studies on possible causes of immunity*, by W. A. Roach, pp. 206-10, bibl. 9. The author concludes from a consideration of previous investigations on the subject by himself and other workers that immunity from woolly aphid does not appear to be explicable in terms of the structure of the host. Aphides have been reared on artificial media prepared from the bark of both immune and susceptible trees. The number of young produced was less and the life period of the aphides was shorter in the dead media from the immune than in that from the susceptible trees. Results suggest that the cause of immunity or susceptibility is carried by a chemical substance insoluble in alcohol and ether and only slightly soluble after prolonged boiling in water.

903. LISTO, J., AND LISTO, E. M. 632.654.2 : 634.1/7
 Lisäkoiketa hedelmäpuupunkin (*Paratetranychus pilosus* C & F) torjumiseksi.
(Further experiments on the control of the red mite of fruit trees.) [Finnish,
 English summary 2 pp.]
Valt. Maatalousk. Julk. 91, 1937, pp. 12.

Previous experiments by the late Jaakko Listo on the same subject were reported in No. 70 of this series of publications. The results achieved by later experiments, which were unfortunately left unfinished at his death in the autumn of 1935, are here set out. The trials were carried out at the Horticultural Institute of Lepaa. Briefly they were conducted thus:—The branches on a given tree were sprayed with the different materials under trial. Pieces of 20-30 cm. in length were then cut from these branches, 3 each from each main branch treated with any given material. The number of eggs on each twig was counted. The twigs were put in wide-mouthed glass bottles which were embedded in the soil of the orchard. The hatched mites were counted and removed from the twigs twice at intervals of one week. Three combined oil-tar distillate preparations in common use in Finland and one American oil spray again showed excellent results when used at 8% strength and their use is, therefore, recommended. It was found in tests in 1934 and 1935 that the later the application, the more effective was the result. Naturally injury to the trees follows if spraying is done too late. Two of the successful sprays caused no damage to the trees when used at a reasonable date, whereas two of them caused mild damage. One oil-tar distillate wash both had a poorer ovicidal effect and a more injurious effect on the trees than the others. In one trial the preventive effect of the sprays on the larvae of *Cheimatobia brumata* was evident.

904. RAHMAN, KH. A., AND BHARDWAJ, N. K. 634.87-2.73
The grape-vine thrips (*Rhipiphorothrips cruentatus* Hood (Thripidae : Terebrantia : Thysanoptera).)
Indian J. agric. Sci., 1937, 7 : 633-51, bibl. 8.

A close morphological and biological study is made of *Rhipiphorothrips cruentatus* Hood, a thrips infesting grape-vine leaves in the Punjab and Southern India. The damage is described. A series of photographs illustrate the visible progress of the attack on the leaf surface while drawings of leaf sections show the effect on the interior of the leaf. An important endo-parasite is described. Infection may be reduced by changing the soil under the vine during winter, since it is here that the thrips hibernate. An outbreak may be controlled effectively and economically by spraying with either a decoction of tobacco and soap, a decoction of "ak" (*Calotropis procera*) and soap or black leaf 40. Instructions for making up these preparations are given.

905. THIEM, H. 634.11-2.793
Über Erfolge bei der Bekämpfung der Pflaumensägewespen. (Successful control of plum sawflies.)
Forschungsdienst, 1937, 3 : 357-68, bibl. 9.

Quassia products in spray form have been proved by recent work in different parts of Germany to be very effective against plum sawflies (*Hoplocampa minuta* Christ, and *H. flava* L.). The quassia used in a 3% solution is not immediate in its effects. Most of the eggs hatch out but the young larvae are weakened, become incapable of much movement, stop eating and become starved and finally fall to the ground. The control is stated to be incomplete but adequate nevertheless.

906. DOTTI, F. 634.22-2.793
L'infuso di legno quassio nella lotta contro le hoplocampa del susino. (Quassia wood infusions for the control of plum sawfly.)
Riv. Frutticoltura, 1937, 1 : 59-88, bibl. 9.

An account is given of trials made in the spring of 1936 to determine the comparative values of quassia solution and arsenate of lead in the control of plum sawfly. Quassia extracts at 1·5 to

2·0% were tested in five cases against 0·3 to 0·4% arsenate of lead solutions, 337 trees being concerned altogether. Notes were made of subsequent infestation 22 days after flowering and in two cases 20 days later, while in all tests the final crop was examined. The most constant datum least influenced by difference in plants was that of infestation 22 days after flowering. The plums were Burbank and Santa Rosa. A glance at the figures shows that the average percentage of infested fruits at that time following quassia treatment was 13·35, whereas following arsenate it was 42·2%. The other and later observations agreed with these proportions. Further laboratory tests were made on over 2,000 bees imprisoned in 100 cells and fed artificially for periods of from 13 to 20 days. Arsenate of lead even at 0·1% proved very poisonous, while quassia extract appeared not to affect the bees even at much higher concentrations than those used against the sawfly. Among advantages said to be held by quassia infusion over lead arsenate are the following:—better control of *Hoplocampa* spp. and of aphids, no scorching of leaves as compared with considerable scorching, no ill effects on bees as compared with severe poisoning by arsenate. Results of lead arsenate against *Hyponomeuta* were found to be slightly better than those of quassia.

907. HAAS, A. R. C. 634.51-2.77

Factors in varietal susceptibility of walnut fruits to attack by the walnut husk fly.

Plant Physiol., 1937, 12 : 721-36, bibl. 4.

A study of the factors involved in the varietal susceptibility of walnut husks to attack by the walnut husk fly (*Rhagoletis completa*) confirms the importance attributed to husk hardness as a factor. The relation is shown between this and other physico-chemical properties of husks in the different varieties. Increased resistance is shown to be associated with increased acidity of the juices of the husk, with a smaller percentage of dry matter in the fresh husks and, in August, with a high percentage of dry matter in the fresh weight of the shells (with kernels). Increased resistance was associated with high percentages of ash, magnesium, potassium, sodium, reducing sugars and total pectin in the dry matter of the husks but not with calcium or total phosphorus. Husk hardness associated with resistance is due largely to cell wall structure and to the distribution of husk tissues.

908. KÜTHE, K. 632.78 : 634.11

Das Auftreten des Apfelwicklers (*Carpocapsa pomonella* L.) in Deutschland 1936. (Codling moth in Germany in 1936.)

Gartenbauwiss., 1937, 11 : 289-96, bibl. 3.

Notes are given on the appearance of the codling moth in Germany in 1936 with special reference to the district round Landsberg (Warthe) and on the incidence of a second generation. A second generation occurred in 1936 in nearly all low lying parts of Germany.

909. TAYLOR, G. G. 632.95

Application of orchard sprays IV. Spray coverage.

N.Z.J. Agric., 1937, 55 : 32-41.

Spray coverage is influenced by the conditions under which the spray is applied and the nature of the surface sprayed. A continuous cover can be easily obtained on a rough surface but on a smooth or waxy fruit the spray remains as relatively large isolated drops with the adjacent spaces filled to a varying extent with finer droplets. With smooth fruit a spreading or wetting agent is essential to provide a continuous cover. Improvement in cover is obtained by applying the spray at 250-300 lb. pressure from a fine nozzle held far enough from the fruit to avoid removal of spray by the air stream produced by high pressure. For hairy fruit a nozzle giving a coarse spray with sufficient force to ensure penetration between the hairs is required and the nozzle should be held as close as possible to the fruit. The above is a summary of the results of experiments carried out to determine (1) the significance of volume of delivery and time of spraying on spray coverage, and (2) the effects of variations in volume delivery on control of codling moth, black spot and red-mite. Each experiment and its result is given in detail. The paper contains much information of practical value.

910. NIKITIN, A. A. 632.952.21

Zeolitic copper compounds as fungicides.

Dissertation, Columbia University, 1937, pp. 72, bibl. 25.

The author describes the preparation under both laboratory and large-scale conditions of a series of copper zeolites. These are essentially copper aluminosilicates in colloidal form produced by the interaction of copper sulphate and sodium zeolite (aluminosilicate). The preparation, properties and composition of the products and the method of assessing their toxicity are discussed at length. It is shown that the presence of basic copper sulphate is prejudicial to the efficacy of the material and increases its phytocidal action. Methods are described for reducing the amount of this component. The effect upon toxicity of variations in constitution and in physical properties is discussed. A zeolite of about 25% copper content was found to be the most effective and was adopted for the investigation of other factors. Increase in the hydrogen ion concentration during manufacture raised the toxicity of the resulting gel but simultaneously increased its phytocidal action; pH 8.0 was eventually selected as the optimum. A ratio of silica to alumina of 3 : 1 was found to be the most satisfactory. The translation of the laboratory process to a commercial scale is described and the consequent problems of mixing, settling, washing, filtering, drying and milling are discussed. It was found that the addition of sodium phosphate to the original mixture of sodium silicate and sodium aluminate overcame certain washing difficulties in the large scale manufacture and gave a highly satisfactory final product which appeared to be of the nature of a copper aluminosilico-phosphate. This material was superior to other modifications in toxicity to spores and in the absence of injury to plants. It was also more economical in manufacture. The author claims that extensive field trials have confirmed the value of the copper zeolites as commercial fungicides and have shown them to be superior to lime-sulphur, bordeaux mixture, and other copper preparations with which they were compared. Sixteen tables and a similar number of graphs set out in detail the data obtained during the investigation.

H.S.

911. GUY, H. G. 632.951 : 547

Investigation of organic compounds as insecticides.

Bull. Del. agric. Exp. Sta. 206 (Technical No. 19), 1937, pp. 60, bibl. 14.

Over 800 organic chemicals have been evaluated as stomach poison insecticides in the endeavour to find an effective substitute for lead arsenate. This is a preliminary report and deals with the substances under the following headings:—phosphoniums, chromium salts, thiazines, thiuram sulphides, thiocarbamates.

912. STAPEL, CHR. 632.951.4

Forsøg med Foraarskarbolineer. (**Experiments on the use of spring carbolineums.**)

Beretn. Forsøksv. PlKult., Lyngby, 304, 1937, pp. 80-111, bibl. 2, reprinted from *Tidsskr. Planteavl*, 1937, **42** : 80-111.

The term "spring carbolineum" is applied to tar or tar-petroleum oil products so compounded with soap-free emulsifiers that they are miscible with bordeaux mixture or lime-sulphur. As the phytocidal action of spring carbolineums is milder they may be applied, at 10% concentration, later than ordinary fruit tree (winter) carbolineums, e.g. on apples until the buds show green at the tips. Admixture with bordeaux mixture reduces phytocidal action, but the spray is so viscous that application is difficult and the combination is recommended only when very late application is necessary or extra fungicidal properties are required. The three spring carbolineums examined gave control of (1) *Anthonomus pomorum*, (2) *Psylla malii*, (3) *Aphis pomi*, (4) *Lecanium corni* and reduced infestation by (5) *Cheimatobia brumata*, (6) *Tmetocera ocellana* and (in the case of one product) (7) *Paratetranychus pilosus*. Against (7) none, even at 10%, was so effective as special carbolineum or a spray oil. Against (2), (3), (5) and (6) the spring carbolineums were as effective as winter carbolineums and in the case of (2) even when in a 5% solution. Against (1) the spring carbolineums were more effective than winter carbolineums probably because they were applied later.

H.M.

913. JAMALAINEN, E. A. 632.95 : 634.11
 Omenapuiden lehtien ja hedelmien ruiskutusvuoituksesta. (**Spray damage on the foliage and fruits of apple trees.**) [Finnish, German summary 4 pp.]
Valt. Maatalousk. Julk. 83, 1936, pp. 35, bibl. 19.
 Notes are given on the damage caused to foliage and fruit of apple trees by commonly used sprays such as bordeaux, lime-sulphur, etc., and on the susceptibility of particular varieties. Most of the findings are tabulated.
914. HOFFMANN, M. B. 634.23-2.951.23
Some results on washing cherries for the removal of spray residue.
Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 275-8.
 The use of the following substances in solution at various strengths for washing cherries is discussed:—hydrochloric acid, acetic acid and several alkaline materials such as soda-ash, sodium silicate and trisodium phosphate.
915. MARSHALL, R. E. 634.11-2.95 : 664.85.11
The relation of washing operations to bruising and keeping quality of McIntosh and Northern Spy apples.
Quart. Bull. Mich. agric. Exp. Sta., 1937, 20 : 34-42, bibl. 3.
 Washing operations accounted for 25-30% of the final bruises found on commercially packed McIntosh apples and 10-12% of those on Northern Spy. Rates of softening, of decay, of shrivelling in storage or following storage were not affected by washing practices.
916. JONES, J. S., AND HATCH, M. B. 634.1/2-2.951.23-1.4
The significance of inorganic spray residue accumulations in orchard soils.
Soil Sci., 1937, 44 : 37-61, bibl. 28.
 Orchard welfare is not directly affected by the inevitable accumulations of spray residue in the soil, since these compounds merely penetrate the soil to the depth to which they are carried by the instruments of cultivation, i.e. from 6-8 inches, and so remain above the usual root run. The suspicion that the occasional failure of surface-feeding cover crops may be due to these residues requires investigation. Any danger to consumers, human or animal, can only arise when in the course of years the fruit trees are removed and the annual food plants taking their place are enriched (as evidence shows they would be) with chemical elements definitely harmful to the animal organism. The reality of this danger is still unproved.
917. WINTER, J. D. 634.1/7-2.693.2
Protecting trees from rabbits and mice.
Minn. Hort., 1937, 65 : 202.
 Some methods advocated of protecting trees from rabbits and mice are:—Against rabbits only, strips of newspaper 18-20 inches wide wound spirally round the main trunk and lower branches, or brown wrapping paper 24 inches high folded round the trunk and held in place with clips applied with stapling pliers, a space being left between the paper and the trunk; against rabbits and mice, $\frac{1}{4}$ inch galvanized wire netting guards. Repellant washes are not usually satisfactory, the best being a resin-copper-soap compound. Field mice can be kept away by mounding earth around the trunk to the height of 1 foot, the grass having previously been cleared away to a width of 3 feet; soon after snow has fallen it is trampled hard close to the trunk, forming a crust which the mice cannot penetrate. The use of a poison bait (not described) is advocated, if mice are numerous.

918. MERRILL, T. A. 631.541.4 : 634.11

Bridge-grafting vs. cleft-grafting girdled young apple trees.

Quart. Bull. Mich. agric. Exp. Sta., 1937, 19 : 175-7.

Cleft grafting requires less time, fewer scions and results in no check as compared with bridge grafting when used on trees with a trunk diameter of 2 inches and under. In larger trees, however, cleft grafts take longer to heal and trees so treated would seldom overtake bridge grafted trees.

919. JOHNSTON, S. 631.541.4 : 634.25

Bridge-grafting the peach.

Quart. Bull. Mich. agric. Exp. Sta., 1937, 19 : 177-9.

Completely girdled 3-year-old peach trees were bridge grafted with shoots of peach and Lombard or Burbank plum placed alternately. The peach shoots failed to form unions and most of the Burbank bridges also died. Most of the Lombard bridges grew satisfactorily but failed to prevent the dying back of the trees.

920. GIMINGHAM, C. T., AND NEWTON, H. C. F. 632.64

A poison bait for slugs.

J. Minist. Agric., Lond., 1937, 44 : 242-6.

An account is given of experiments in the use of a mixture of Meta and bran as a poison bait for slugs, including a large scale field experiment in April over more than an acre, which gave an estimated kill of over 50,000 slugs per acre in the centre of the field and 70,000 per acre near the hedges. The counts from which the estimate is made were taken on 64 separate sq. ft. areas across the middle of the field and 44 areas of similar size near the hedges. The bait was broadcast. An effective concentration is 1 stick (4 g.) of Meta well mixed with 2 pints (about 8 oz.) of slightly moistened bran. Leatherjackets were scarcely affected, whereas on a wheatfield baited in similar fashion with Paris green and bran a 100,000 kill of leatherjackets per acre was made.

VEGETABLE GROWING, STIMULANTS, FIBRES.*

921. SCHUPHAN, W. 635.1/7 : 581.192

Der gegenwärtige Qualitätsbegriff bei Gemüsen u. die Notwendigkeit seiner Erweiterung auf chemisch erfassbare Wertmerkmale. (Quality standards in vegetables and the need that chemical composition should partly determine them.)

Forschungsdienst, 1937, 3 : 290-303, bibl. 13.

The author urges that the value of vegetables should be judged much more according to their chemical composition, e.g. protein N, total sugars, ethereal oils, vitamins, etc., than on mere outward appearance, as has hitherto been usual. He considers that vegetable breeders should aim at combining desirable qualities and that the new vegetables thus produced should be tested on particular soils to discover under what soil conditions these qualities persist. Finally the effects of different manuring should be tested by the resulting chemical composition of the vegetable under different environmental conditions and, according to results, advice given on the best environment and nutrient treatment of particular vegetables. He illustrates his point with a considerable number of data on celery varieties grown under varying nutrient conditions at Grossbeeren, Weihenstephan and elsewhere.

922. RAUTERBERG, E. 635.1/7 : 631.84 : 581.192

Methodische Vorarbeiten zur Bestimmung der Eiweissqualität in Gemüse. (Preliminary tests for the determination of protein quality in vegetables.)

Forschungsdienst, 1937, 4 : 184-9.

The author shows how the different nitrogen fractions in vegetables are influenced by manuring. Spinach was manured with $\text{Ca}(\text{NO}_3)_2$ and with NH_4NO_3 and the resulting respective crops

* See also 869, 871-873.

analysed. In nearly all cases the figures given for nitrogen contents of the spinach manured with NH_4NO_3 were greater than those from the $\text{Ca}(\text{NO}_3)_2$ manured plants. Protein content was somewhat higher, also content in non-protein nitrogen and especially NH_3 content. The whole substance also contained a greater amount of amino-acid nitrogen. The α amino-acid N content in the proteins was about the same, only the non-protein substances differing in this respect. It would appear from these investigations that the form of nitrogenous manuring has considerable influence on the different nitrogen fractions in vegetables.

923. DRÜHE, K. 635.13
 Die Gartenmöhren vor der Bereinigung. (**Carrot varieties, the present confusion in nomenclature.**)
Gartenbauwiss., 1937, 11 : 329-34.

The author notes the present confusion that exists in Germany with regard to the names of carrot varieties and the characteristics of named varieties. He lists those which are thought to be synonymous, but shows that the characteristics attributed to any given variety vary from place to place. The frequency of occurrence in commercial and other literature of different characteristics attributed to 17 varieties grown in Germany is tabulated.

924. BOSWELL, V. R. 635.24
Growing the Jerusalem artichoke.
Leafl. U.S. Dep. Agric. 116, 1936, pp. 8,
 and
 BOSWELL, V. R., AND OTHERS.
Studies of the culture and certain varieties of the Jerusalem artichoke.
Tech. Bull. U.S. Dep. Agric. 514, 1936, pp. 69, bibl. 8.

The first leaflet contains practical instructions for selection of tubers and all the operations of planting the sets, cultivating the plant, and harvesting and storing the crop. In the technical bulletin an account is given of experiments carried out near Washington D.C., and in Illinois, Minnesota, Oregon and Wyoming, in which the effects of the following factors were noted:—environmental conditions, varietal differences, size of seed piece, time and method of planting, depth of planting, planting distances, harvesting tops for silage and the eradication of volunteer growth. Among the recommendations made are the following:—plant as early as the soil can be worked in the spring; plant seed pieces of about 2 oz. preferably whole, but cut if necessary; except under favourable semi-humid conditions plant in rows 3 ft. apart with seed pieces 2 ft. apart in the rows; in very favourable conditions space much more widely; cover seed pieces to a depth of 4 in. normally or 5 in. where the surface soil dries out quickly. Follow artichokes with a late sown, quick growing hay crop or cultivated crop.

925. TRESSLER, D. K., AND OTHERS. 635.41 : 577.16
Vitamin C content of vegetables. 1. Spinach.
Food Res., 1936, 1 : 3-7, bibl. 10.

The ascorbic acid contents of 12 varieties of spinach grown in N.Y. State on an upland clay loam soil and also on a muck soil were compared in one season, all samples being harvested and analysed on the same day. The mean values obtained were, muck soil 0.49 and upland soil 0.75 mg. per gram. Varietal differences were also found, but these are thought to have been of secondary importance. Determinations made on two varieties showed that the vitamin C content of spinach cut for market exists principally in the leaves, and that the stems are almost devoid of this vitamin. When spinach was stored at 1° to 3° C. the ascorbic acid content declined very slowly, but when samples were stored at room temperature about one-half the ascorbic acid was lost in 3 days and practically all of it in 7 days. There was little change in the ascorbic acid contents of growing spinach leaves during a harvest period of one week.

926. BEATTIE, W. R. 635.52
Lettuce growing.
Fmrs' Bull. U.S. Dep. Agric., 1609, pp. 27,
 and
 BEATTIE, J. H. 635.52 : 631.544
Lettuce growing in greenhouses.
Fmrs' Bull. U.S. Dep. Agric. 1418, pp. 22.

These two bulletins deal with lettuce production in the open and under glass, with special reference to conditions obtaining in the Eastern part of the United States. The whole business from seed selection to marketing is dealt with and brief notes are given in each case of the more usual pests and diseases and their control.

927. WELLMAN, F. L. 635.53 : 632.8
Control of southern celery mosaic in Florida by removing weeds that serve as sources of mosaic infection.
Tech. Bull. U.S. Dep. Agric. 548, 1937, pp. 16, bibl. 13.

A thorough testing of 10,000 celery plants comprising 77 varieties or strains showed none of them to be resistant to the southern celery mosaic. Results of trials of weed eradication and spraying insect vectors (aphides) have led to the following recommendations being made :—
 (1) Complete eradication of all weeds for a distance of 75 feet around seedbeds before planting ;
 (2) removal of weeds especially wild Wandering Jew (*Commelina nudiflora*) from around fields for a distance of 75 or more feet ; (3) the first removal of weeds to be completed before seedlings are transplanted ; (4) the removal of weeds to be carried out about 5 times during the celery growing season.

928. FIKRY, A. 632.421.1 : 635.61/3
Powdery mildew of Cucurbitaceae.
Bull. Minist. Agric. Egypt (mycol. sect.) 175, 1936, pp. 25.

The symptoms and control of *Erysiphe cichoracearum*, one of the most destructive diseases of melons, cucumbers and other cucurbits in Egypt are described in detail and excellently illustrated by 24 plates. Only water melon is not severely attacked except in certain humid districts in the Nile Delta. Dusting with flowers of sulphur and spraying with burgundy mixture or with 1-2% bordeaux mixture are found to effect 95-100% control. Burgundy is preferred to bordeaux as being easier to prepare. Two applications of one of these remedies suffice, one directly after the disease occurs, the other 3-4 weeks later. A third may be applied if further symptoms appear. Sulphur is best applied through a muslin bag fitted with a wooden holder [illustration given.—ED.].

929. PORTSMOUTH, G. B. 635.63 : 612.014.44
The effect of alternate periods of light and darkness of short duration on the growth of the cucumber.
Ann. Bot., Lond., 1937, 1 : 175-89, bibl. 6.

Experiments carried out at the Research Institute of Plant Physiology, London, are described in which cucumbers are grown under constant conditions of temperature and humidity with three different types of illumination, namely twelve-hour alternations of light and darkness, one-minute alternations of light and darkness, and continuous light. From the data presented it is concluded that assimilation rates in continuous light and under one-minute alternations are almost the same : the rates are much lower than with twelve-hour alternations. With twelve hour periods the rate of assimilation remains nearly constant, whereas it declines in the cases of the one minute alternations and the continuous light. The total amount assimilated per unit surface in twenty-four hours is almost the same under continuous light and with twelve-hour alternations. Under the short-period alternations only half the amount was assimilated. Part of the differences in assimilation are shown to be due to the closure of the stomata with one-minute alternations.

930. EWART, A. J. 635.64 : 581.175.11

Pigment glands of the tomato.

Ann. Bot., Lond., 1937, 1 : 563-4.

A pigment similar to or identical with citrinin has been extracted from the glands of the tomato plant. As extracted from the tomato, however, it has the peculiarity that in an alkaline solution it rapidly oxidizes to an insoluble brown compound. Evidence of the pigment elsewhere in the plant than in the glands was not obtainable.

931. PORTER, A. M. 635.64 : 581.035.3

Effect of light intensity on the photosynthetic efficiency of tomato plants.

Plant Physiol., 1937, 12 : 225-52, bibl. 24.

The effect was studied of light intensity on the photosynthetic efficiency of tomato plants (Grand Rapids Forcing) under 3 different daily average light intensities, namely 1139.9, 583.1, and 261.0 foot candles. With a decrease in light intensity there was an increased vegetative growth as measured in leaf area and both fresh and dry weight, a decreased fruit production and a decrease in the total amount of photosynthate produced. These changes were not directly proportional to the decreases in light intensity, for instance a reduction of light intensity by one-half resulted in approximately only a one-fourth increase in amount of vegetative growth. Great differences were exhibited between the plants exposed to any one light intensity in their ability to utilize the available light supply, some individuals in a moderately shaded group and one in the heavily shaded group producing nearly as much photosynthate per unit of leaf as some of the least efficient in the unshaded group. The value to the grower of strains of tomatoes possessing high photosynthetic efficiency under low light intensities is pointed out. So far no attention has been paid to the development of such strains.

932. CHRISTOPHER, E. P. 635.64 : 581.132

Carbon dioxide assimilation of the tomato.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 527-35, bibl. 7.

Carbon dioxide assimilation of tomato leaves did not follow light intensity closely and was not influenced by bordeaux spray 4-4-50 or by lime solution. Copper sulphate solution caused some spotting and a marked reduction in CO₂ assimilation.

933. MCHARGUE, J. S., AND CALFEE, R. K. 635.64 : 631.811.9

The necessity of minor elements for the growth of tomatoes in poor soil.

J. Amer. Soc. Agron., 1937, 29 : 385-91.

Marked beneficial results in the growth of tomatoes were obtained from the addition of small quantities of compounds of the minor elements to the soil. The plants were grown in acid-resistant earthenware jars holding 6.5 kg. each of a depleted sandy silt loam of which the acidity had been brought from pH 5.8 to pH 6.6 with pure calcium carbonate. When adequate amounts of the major elements only were added, the fruit produced was of inferior quality to that from the cultures receiving compounds of both major and minor elements.

934. MELVILLE, R. 635.64 : 581.14

The influence of environment on the growth and metabolism of the tomato plant II. The relationship between water content and assimilation.

Ann. Bot., Lond., 1937, 1 : 153-74, bibl. 8.

A significant rise in the percentage water content of seedling tomato plants grown in a greenhouse was brought about by exposure to 6 additional hours of darkness daily. A seasonal drift was observed in the percentage water content of the plants. A negative correlation of 0.6 was found between mean night temperature and percentage water content in the morning. A positive correlation of 0.8 was found between the length of the night and the percentage water content on the following morning. Gain in dry weight increases to a maximum as water content

increases. Further increase of water content results in a rapid decline in the rate of gain in dry weight. The optimal percentage water content is dependent on light. The experiments were carried out at the Research Institute of Plant Physiology, London, and at the Research Station, Cheshunt.

935. WHITE, P. R. 635.64 : 581.143.6

Seasonal fluctuations in growth rates of excised tomato root tips.

Plant Physiol., 1937, 12 : 183-90, bibl. 18.

The growth rates of a clone of isolated tomato root-tips grown *in vitro* showed seasonal fluctuations which, it was found, were due to an extreme sensitivity to temperature differences. The effect of seasonal fluctuations in illumination is negligible.

936. MACLINN AND OTHERS. 635.64 : 577.16

Tomato variety and strain differences in ascorbic acid (vitamin C) content.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 543-52, bibl. 8.

Data are given bearing on the effect of variety and strain, size of fruit, maturity and storage on the vitamin C content of tomatoes. Ninety-eight distinct varieties or strains were compared, and the variation ranged from 249 units per ounce to only 74 units. A good vitamin C potency has been fixed as 150 units per ounce. There were also marked differences in vitamin C content between different strains of the same variety. No correlation was found between vitamin C content and size or degree of maturity. Storage for 10 days at room temperature did not affect the vitamin C content. By the use of the rapid dye titration technique as a check a selection and breeding programme to increase the vitamin C content of tomatoes may be readily carried on.

937. BERKELEY, G. H. 635.64 : 632.8

Prevention of virus diseases of greenhouse grown tomatoes.

Circ. Dep. Agric. Can. 118 (Publ. 552), 1937, pp. 7.

The more important virus diseases of tomato in Canada are:—common tomato mosaic, yellow tomato mosaic, potato mosaic, cucumber mosaic, and streak disease. Spraying has proved of no avail and no satisfactory resistant variety has as yet been evolved. Among the practical precautionary measures suggested by the author as likely to prevent the spread of the disease are the following:—Seed selection from healthy plants; growth of seedling in sterilized soil; growth if possible in a house free of old tomatoes; if grown anywhere near diseased plants great care should be taken to wash hands and implements after dealing with old plants before touching new seedlings; no smoking should be allowed before or while working with the seedlings; all mosaic or streak plants seen in the seedbed should be at once eliminated; rotation with some other crop should be practised; roguing should continue after transfer to permanent quarters; weeds should not be allowed in the beds; neither potatoes nor cucumbers should be grown close to the tomatoes, since potato and cucumber viruses in conjunction with tomato mosaic produce a severe form of tomato streak; insects should be kept down by frequent fumigation, the tobacco used for this being then removed; tobacco trash should only be used as a fertilizer after sterilization.

938. ROBBINS, W. R. 635.64 : 631.81.031 : 632.19

Relation of nutrient salt concentration to growth of the tomato and to the incidence of blossom-end rot of the fruit.

Plant Physiol., 1937, 12 : 21-50, bibl. 37.

Tomato plants (Marglobe) were grown in sand culture under glass with nutrient solutions of 5 different osmotic concentrations. Nutrient solutions of 0·08 atmosphere osmotic value (a.o.v.) supplied at the rate of 1 litre per day resulted in a limited growth, but when the supply was 4 litres per day good vegetative growth was made. The best growth and greatest total green and dry weights per plant were obtained from plants grown in solutions of 0·44, 0·83 and 1·7 a.o.v. At 3·1 a.o.v. growth was apparently hindered by the low available water for

tissue development. At each concentration fruit set freely, those fruits grown with solutions of 0·08 a.o.v. being exceptionally large and those with solutions of 3·1 a.o.v. very small. Roots grown with solutions 0·08 a.o.v. were brittle, large, white and slow in maturing, but with 3·1 a.o.v. they were tougher, smaller, creamy yellow to brown and matured comparatively fast. Under conditions of low transpiration guttation took place abundantly from the leaves of plants grown in the lowest concentration but not at all from those grown in the 2 highest concentrations. Blossom-end rot developed on 80% of the plants grown in the 2 highest concentrations (1·7 and 3·1 a.o.v.) and none on the fruits from the lowest. The development of blossom-end rot was associated with wide fluctuations of rates of transpiration. Fruit cracking occurred only at low transpiration intensities and only in the case of plants grown in the lowest concentration. There was a difference of 4 atmospheres between the osmotic values of extracted juices of similar tissues of plants grown in the highest and lowest concentrations. There was an osmotic gradient of 1·62 to 3·63 atmospheres between extracted juices of the fruits and those of the stems and leaves in plants grown with each of the concentrations employed. The significance is discussed of the differences in osmotic and imbibitional pressure of fruit and leaf tissues of the plants in the various series in relation to the incidence and development of blossom-end rot. The importance of the factors of light, temperature, humidity, rate of air movement, pH value and oxygen tension of the solution to the development of blossom-end rot on fruits in solutions of different nutrient salt concentrations is noted.

939. CHAMBERLAIN, E. E., AND BRIEN, R. M. 635.64 : 632.48
Experiments in the control of tomato leaf-mould.

N.Z. J. Agric., 1937, 55 : 82-8, bibl. 2.

The paper covers three years' experiments on the control of tomato leaf mould (*Cladosporium fulvum*) by the use of therapeutants. None, however, proved a substitute for adequate ventilation. Where the humidity of the greenhouse can be to some extent controlled, consistently best results against *Cladosporium* were given by "Shirlan A.G." 0·3% concentration (a proprietary compound containing 25% salicylanilide, 10% Agral -an organic proprietary wetting agent, and 65% water). Other materials giving sufficient control to justify their use are, in order of merit, lime-sulphur + Agral, lime-sulphur + colloidal sulphur, lime-sulphur. None of these caused foliage injury.

940. THOMAS, C. A. 635.64 : 632.78

The tomato pin worm.

Bull. Penn. Agric. Exp. Sta. 337, 1936, pp. 15, bibl. 28 ;
 and

ELMORE, J. C.

The tomato pin worm.

Circ. U.S. Dep. Agric. 440, 1937, pp. 8.

Brief accounts are given in these two papers of the tomato pin worm (*Gnorimoschema lycopersicella* Busck) and of its control.

941. KRAUSCHE, K. K., AND GILBERT, B. E. 635.64 : 632.952 : 581.113

Increase of transpiration rates of tomato leaves due to copper sprays.

Plant Physiol., 1937, 12 : 853-60, bibl. 4.

It appears probable that soluble copper and calcium on a leaf surface will by penetration induce changes in permeability in the membranes of the guard and mesophyll cells and thus affect transpiration (it has been shown by several observers that copper sprays increase leaf transpiration in many plants particularly at night). This increase of transpiration takes place directly through the epidermis by the process of exosmosis caused by the presence of the spray film on the surface, and not through the stomata, which remain unaffected.

942. TANAKA, Y. 581.143.26.03 : 635.651
The effect of the preliminary low temperature treatment in accelerating the flowering of the broad bean. [Japanese, English summary.]
J. hort. Ass. Japan, 1936, 7 : 365-71, bibl. 5.

The seed of two varieties of broad bean was sown after submission to the following different treatments:—1. Soaked for 12 hours and then submitted to temperature of 10° C. for 21 days, 2. ditto, but exposed to 10° C. for 18 days, 3. ditto but for 16 days, 4. soaked and then submitted to 5° C. for 16 days, 5. soaked and submitted to 10° C. for 10 days, 6. soaked and submitted to 5° C. for 10 days, 7. soaked and submitted to 10° C. for 3 days, 8. merely soaked for 12 hours, 9 and 10. sowing of seed without any preliminary treatment. As a result the greatest advancement in the time of flowering was achieved by treatment 1, i.e. soaking for 12 hours and then submitting to a temperature of 10° C. for 21 days. In this case the average number of days from sowing to flowering was 34.8 days as against 104.2 days in the untreated seed of the same variety. It is suggested that a mass treatment on these lines is likely to result in much earlier broad beans. It is further suggested that treatment on these lines may result in the much earlier production of a large number of other vegetables.

943. DAY, D., AND COMBONI, S. 635.656 : 581.192 : 631.416.4
Effects of potassium deficiency on the formation of starch in *Pisum sativum*.
Amer. J. Bot., 1937, 24 : 594-7, bibl. 16.

The formation of carbohydrates in the cells of the leaf of *Pisum sativum* (Canada field pea) is shown to be distinctly less when potassium is lacking.

944. MACK, G. L., AND OTHERS. 635.656 : 577.16
Vitamin C content of vegetables. 2. Peas.
Food Res., 1936, 1 : 231-5, bibl. 7.

The effects of variety, maturity and storage on the ascorbic acid content of peas grown in New York State were determined by the 2, 6 dichlorophenolindophenol titration method. With two samples the results were also confirmed by biological assays. Variety proved to be an important factor; among 17 varieties grown on the same soil under similar conditions some contained nearly twice as much vitamin C as did others. In general it was noted that the early small-seeded varieties were better sources of the vitamin than the late large-seeded types. The percentage of ascorbic acid was found to decrease as the peas matured, the percentage being inversely proportional to the sieve size of the peas of any given variety. Peas stored in the pod at 1° and 9° C. lost practically no vitamin during 6 days, whereas very considerable losses occurred in peas stored at 18° and 22° C.

945. SPENCER, E. L. 633.71-2.8 : 631.8
Influence of host nutrition on systemic development of tobacco mosaic.
Plant Physiol., 1937, 12 : 825-32, bibl. 5.

The systemic development of a yellow strain of tobacco-mosaic virus in tobacco plants in sand cultures was accelerated by high-nitrogen nutrition and retarded by high-phosphorus and by high-potassium nutrition.

946. BERKELEY, G. H. 633.71-2.8
Prevention of tobacco mosaic in Ontario.
Circ. Dep. Agric. Can. 119 (Publ. 555), 1937, pp. 7.

Owing to the neglect of preventive measures tobacco mosaic has increased considerably in the last 10 years in Ontario and Quebec. The author makes the following recommendations:—1. Use steam-sterilized soil in the seed bed in order that any virus present in the soil may be destroyed. 2. Use only well-cleaned seed from healthy plants. 3. Do not store boards and canvas from plant beds in curing or packing barns or any other place where they are likely

to become contaminated with tobacco refuse. 4. Wash the hands thoroughly with soap and water, preferably under running water before working with tobacco, whether in the seed bed or field. 5. If mosaic appears in the seed bed, all diseased plants and the immediately surrounding plants should be pulled and destroyed. 6. Weeding should not be carried out while the plants are wet. 7. Do not smoke or chew tobacco while working with tobacco. 8. Repeated washing of the hands while transplanting is strongly recommended. 9. Rotate tobacco with some other crop. 10. Rogue all mosaic plants before each cultivation. 11. Do not cultivate, hoe or work amongst tobacco while the leaves are wet. 12. It is not advisable to re-set tobacco plants in soil from which mosaic plants have recently been rogued. 13. In topping, suckering, etc., treat all healthy plants as a group, leaving mosaic plants until later. 14. Do not tolerate weeds in either the seed bed or field. 15. The implements used in a badly infected field should not be transferred to a healthy field unless they have been washed free from virus, or disinfected.

947. BEARD, F. H. 633.79-2.411
Observations on the incidence of downy mildew on new seedling varieties of hops at East Malling, 1924-36.

J. Pomol., 1937, 15 : 205-25, bibl. 10.

Observations are recorded on the incidence of *Pseudoperonospora Humuli* from 1924 to 1936 on new seedling hops and on strains of Fuggle grown at East Malling. Variation in intensity and in the form of disease is shown to be largely influenced by spring and summer rainfall. Seedlings of certain crosses have on the whole a high percentage of hills bearing spikes, while certain seedlings of *H. americanus* and *H. neo-mexicanus* have proved very susceptible to attack on the cones. The behaviour of particular seedlings is noted. Only two seedlings so far tested have shown any very marked resistance to this disease. Fuggle has proved resistant at East Malling, but it would appear that there are several strains of this variety in cultivation. Routine spraying with bordeaux largely prevented attacks of disease on the cones.

948. MAZZARON, A. 633.88.34.187-1.8
Dell'influenza di concimi diversi sulla produzione e composizione dell'essenza di timo. (The effect of different manures on the production and composition of thymol.)

Ital. Agric., 1937, 74 : 119-22.

A fourth year's results of manurial trials with thyme (see *Ibidem*, 72 : 472, and 73 : 361; *H.A.*, 1935, 5 : 657, and 1936, 6 : 770) enables the author to sum up his results and come to the following conclusions:—Nitrogen increases production each year but after the first year results in an inferior and less fragrant product. Lime has no direct effect on the plant but has an indirect one on organic matter, favouring nitrification to a smaller or larger extent according to the season. Potassium results in slightly increased growth without any deterioration in organoleptic or chemical qualities. Phosphates have little effect on thyme growth and hence on the essential content but improve its organoleptic and chemical qualities. The best fertilizers for thyme are, then, potash and phosphates with just enough nitrogen to ensure initial growth.

949. BREDEMANN, G. 633.522
Züchtung des Hanfes auf Fasergehalt. (Breeding hemp for fibre content.)

Forschungsdienst, 1937, 3 : 398-410, bibl. 4.

The author gives an account of the fibre content shown in the years 1933-1936 by his hybrid hemp plants which are the result of crossing high fibre male and female hemp with one another and low fibre parents with one another. He has succeeded in raising the fibre percentage in three cases by 20, 20, and 30%, i.e. from 11.0 to 13.2%, from 11.5 to 13.8% and from 9.3 to 12.1% respectively. His low fibre crosses have shown that the low fibre factor is an inherited one and his work shows it to be essential that low fibre male and female plants should be eliminated promptly when breeding for high fibre plants.

FLOWER GROWING.

950. LAURIE, A. 635.9

A retrospect. Looking back ten years on floricultural research.
Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 669-76.

This is a survey of recent progress in floriculture in the U.S.A. and is useful as showing where particular work is in progress. Three men, Waugh, Bailey and Blair, at Massachusetts, Cornell and Illinois agricultural experimental stations respectively, have done much to set floricultural work on a satisfactory footing. Early "research" was concerned almost entirely with classification of varieties and classification of nomenclature. Work at Illinois, Michigan, Ohio and Cornell has led to the present fertilizer recommendations for glasshouse crops. Chlorosis of roses, hydrangeas and azaleas has been investigated at Ohio and New Jersey and found to yield to ferric and ferrous sulphate treatment. Sand culture work at New Jersey, Ohio and Purdue has thrown much light on various physiological disorders in different flowering plants. Ohio has worked out a series of symptoms of nutrient deficiencies on greenhouse crops, so that these can easily be detected. Optimum pH ranges have been worked out for a large number of ornamentals at the Ohio, New Jersey and Illinois stations. Soil sterilization with steam has been studied at Illinois and Ohio. Cornell and Ohio have studied fertilizers for trees, Michigan, Ohio and Minnesota the use of peats. Photoperiodism and its problems have been the study of Ohio, Cornell, Purdue and the Boyce Thompson Institute, and the ideal conditions for a large number of ornamentals have been determined. Cornell has studied problems connected with dormancy and the best methods of breaking it. The U.S. Department of Agriculture has led the way in precooling bulbs for early flowering, while other forcing technique for bulb treatment has been worked out in California, Iowa, Illinois and Ohio. Other rest period problems have received attention at Cornell and Massachusetts. Ohio has studied the problems of watering and evolved an optimum technique for that operation. Vegetative reproduction and the proper treatment of seeds has been treated very thoroughly by the Boyce Thompson Institute, and there, too, considerable research has been carried out on chemical stimulation of root formation from cuttings. Vegetative reproduction of ornamentals has also been studied at Cornell, Ohio, Michigan, Illinois, Massachusetts and Iowa. Work at Cornell, Wisconsin and Ohio has been devoted to the growth of plants under reduced light screened off by overhead cloth. Breeding work in California and Massachusetts has been devoted to the production of rust proof antirrhinums and wilt proof asters. Chrysanthemums and roses have been bred at Illinois and Iowa and at present considerable breeding work on ornamentals is taking place at the U.S. Department of Agriculture under Emsweller. Attempts are being made at Illinois, Iowa, Cornell, Ohio and Boyce Thompson to find methods for prolonging the life of cut flowers. So far physiological, morphological and anatomical studies in floriculture have not made much progress. Again little has been done on the economics of the industry other than the compilation of data on costs of production by Ohio and Michigan and studies at Ohio on consumer interest in flowers.

951. SHEWELL-COOPER, W. E. 635.975.34

The cultivation of asparagus fern.
J. Minist. Agric., Lond., 1937, 44 : 458-64.

An account is given of the cultivation of asparagus fern (*Asparagus plumosus nanus*) under glass in the Swanley district of Kent.

952. LINK, C. 612.014.44 : 581.145.1/2

Preliminary studies on flower bud differentiation in relation to photoperiodic response.

Proc. Amer. Soc. hort. for 1936, 1937, 34 : 621-3.

Anatomical studies made of chrysanthemum buds taken each day during a period when their length of day was artificially reduced to 10 hours showed that the growing point began to differentiate floral primordia within 8 to 10 days after the treatment had started. When shading was discontinued after 8 days the differentiated flower bud continued to develop. Those

shaded for 6 days only continued to grow vegetatively. When, however, the plant was only shaded from 8-20 days a secondary bud-like formation (probably an attempt to form the crown bud) took place in the centre of the first-formed flower bud. If shaded over 20 days well-developed flowers were produced. By this treatment the flowering period was advanced by nearly 5 weeks. Microchemical tests of tip and stem were made daily for starch, reducing sugars, nitrates, protein and ammonium until the bud was $\frac{1}{4}$ inch in diameter. An application of ammonium sulphate was given 16 days after shading had begun. As soon as flower bud formation started both in shaded and normal plants, nitrates in the stem dropped and remained very low until the application of the ammonium sulphate, when they increased rapidly.

953. POESCH, G. H. 635.939.98 : 612.014.44

Prolonging the flowering period of chrysanthemums with the use of supplementary illumination.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 624-6.

Supplementary additional light applied before August 15 and discontinued on October 1 effectively retarded flower bud differentiation in chrysanthemums. The most satisfactory illumination was provided by Mazda lamps emitting at least 3 foot candles at the furthermost point from the lamp. Strong growing varieties proved the most adaptable to this treatment. The last pinching back should be made shortly before applying the extra light.

954. CHADWICK, L. C. 634.972-1.8

Fertilizer trials with shade trees in the nursery.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 664-8, bibl. 1.

Tentative conclusions drawn from fertilizer experiments which have been in progress for 5 years on young shade trees (*Ulmus americana Moline*) at the Ohio State University are :—ample moisture is necessary for a favourable response; autumn applications give the best results; the most successful fertilizer is a complete one high in nitrogen or a mixture of ammonium sulphate and superphosphate; growth is stimulated more by ample moisture than by additional applications of fertilizers.

955. O'LEARY, K., AND GUTERMAN, C. E. F. 632.48 : 635.935.722

***Penicillium* rot of lily bulbs and its control by calcium hypochlorite.**

Contr. Boyce Thompson Inst., 1937, 8 : 361-74, bibl. 9.

Of a number of substances tried only calcium hypochlorite powder (20-27% available chlorine) mixed with packing soil at the rate of 160 grams to 50 lb. of soil gave excellent results as a control against *Penicillium* rot and without injury to the bulbs or resulting plants. The same concentration also controlled the bulb mite *Rhizoglyphus echinops* F. & R.

956. RAINIO, A. J. 635.944 : 632.3

Tutkimuksia gladiolus-kasvien ja Niiden torjunnasta. (Bacterial diseases of gladiolus and their control.) [Finnish, German summary 9 pp.]

Valt. Maatalousk. Julk. 84, 1936, pp. 102, bibl. 32.

The diseases dealt with are *Pseudomonas marginata*, *Pseudomonas gummisudans*, *Bacillus omnivorus* and *Bacillus variegatus*. The organisms and the damage done by them to gladiolus plants are described in detail and the effect of soil and other environmental conditions are also noted. The full and useful German summary concludes with the following recommendations :—
 1. Before planting remove the outer membranous sheaths from the bulbs. 2. Use only healthy or very lightly infected bulbs. 3. Treat bulbs, cleaned as above, on the day before planting by dipping into 0.25 or 0.5% sublimate or 0.5% potassium permanganate solution. Formalin solution at a strength of 1 : 100 to 1 : 200 can also be used, provided its growth checking properties are realized. 4. Sunny positions are the best and a rather acid soil. 5. Plenty of water should be given during the growing period. 6. The bacteria can overwinter in the soil, hence diseased plants should be destroyed and no *Iridaceae* planted in the infected soil for some years.

957. FIKRY, A. 632.4 : 635.939.516 + 635.939.43

Diseases of phlox and antirrhinum.

Leaf. Minist. Agric. Egypt (mycol. sect.) 76, 1936, pp. 6.

The symptoms and control of the following diseases or pests are briefly set out:—powdery mildew (*Erysiphe cichoracearum*) and leaf spot (*Septoria Phlogis*) of phlox, and wilt (*Fusarium Solani* var. *Martii*) and eelworm (*Heterodera* spp.) in antirrhinum.

958. OYLER, E., AND BEWLEY, W. F. 635.939.124 : 632.411
A disease of cultivated heaths caused by *Phytophthora Cinnamomi Rands.*

Ann. appl. Biol., 1937, 24 : 1-16, bibl. 20.

A wilt disease of *Erica hyemalis*, *E. nivalis* and *E. Willmoreana* resulting in the plants becoming dry and brown has been traced to *Phytophthora Cinnamomi*. The organism was shown capable of causing a similar disease in *Antirrhinum*, *Calceolaria*, *Schizanthus* and beech seedlings. Infection was traced to water tanks, "standing out" ground, and plunging material. The tanks were successfully treated by scrubbing and filling with 40% formaldehyde solution, 1 gallon to 49 gallons water. The need for thorough cleaning of discarded pots is emphasized. [From authors' summary.]

CITRUS AND SUB-TROPICALS.

959. FAWCETT, H. S. 634.3-2.4
Observations on citrus conditions in Brazil.

Calif. Citrogr., 1937, 22 : 456, 459.

There are about 4,500,000 orange trees in the neighbourhood of Rio de Janeiro and 7,200,000 in the State of São Paulo. Other States of Brazil have little foreign export. Round Rio de Janeiro the chief varieties are Pera, Selecta and Bahia (Washington Navel). Principal diseases and pests in this district are brown rot gummosis, psoriasis, zonate chlorosis, melanose, stem end rot, sweet orange fruit scab, rust mite, scale insects in variety and fruit flies. Sweet orange fruit scab differs from other forms of scab and occurs only in certain areas of S. America. Zonate chlorosis, probably a virus, is also peculiar to Brazil. The Government standard for export is high and 20% of the fruit is refused export, but sells readily in local markets. Brown rot gummosis is very effectively avoided by planting on mounds 8 inches above the surrounding soil, combined with the use of a bordeaux wash round the base of the tree. São Paulo conditions are more sub-tropical than tropical. Here Bahia orange, tangerines and grapefruit are grown. The most important diseases are brown rot gummosis, leprosis and sweet orange fruit scab. The last is prevalent and requires up to 3 sprayings with bordeaux to control it. The industry is developing rapidly.

960. HODGSON, R. W. 634.3
The citrus fruits of India.

Calif. Citrogr., 1937, 22 : 504, 513-4, 517.

An account is given of the kinds of citrus fruit commonly grown in India. The difficulties to the foreigner of nomenclature in India, where the name of each fruit variety changes with the locality, the transliteration is not fixed and there are a multiplicity of forms unknown outside the country, are very great. The author has done a useful service in collecting these fruit names and assigning them as far as possible to their English equivalents. Certain rootstock reactions are recognized and briefly noted. A distinctive cultural Indian practice is the control of the period of bloom and hence the maturity of the crop by induced wilting through root exposure. The method is as follows. Two months prior to the usual flowering time the soil is drawn away from the main roots and the fibrous rootlets are removed. Water is withheld until the trees wilt and part of the leaves are shed. The exposed roots are then covered with a mixture of soil and manure and the trees are watered. Within three weeks they break with

a much heavier bloom than would otherwise have been the case and set a much larger crop. The practice is only effective in the dry season. The treatment has a devitalizing effect on the trees. Brief allusions are made to pests, diseases and current research.

961. BRAVERMAN, J. S. 634.31 : 581.192

The composition of Palestine oranges.

Hadar, 1937, 10 : 147-52, bibl. 8. .

The results are given of tests made over 2 consecutive years on Jaffa oranges taken from a different tree each year, both trees being on sour orange rootstock and growing in light sandy soil. The density of small oranges was in general greater than that of larger fruit. The surface areas varied independently of their variations in weight; the percentage of juice decreased during the period following the first rains; total solids in and specific gravity of the juice increased during the ripening of the fruit, whereas acidity decreased regularly; there was no great variation in the hydrogen ion concentration of the juice; factory experience showed the preservation of juice to depend rather upon total acidity than pH; the increase of total sugars was due mainly to sucrose, the total quantity of reducing sugars remaining practically constant during the season; the amount of oil per square unit of peel surface increased with maturity.

962. ASAMI, Y. 634.322

Japanese mandarin oranges.

J. hort. Ass. Japan, 1937, 8 : 197-9.

Much the commonest mandarin orange variety grown in Japan is the Unshiu (or Satsuma). It is a comparatively large variety with an average diameter of about 2·4 in. There are, however, various strains. It is exported not only as fresh fruit but also canned. Great Britain takes 84% of the canned product. From January to June 1937 the total export was 590,000 boxes, each containing 4 doz. 1 lb. cans.

963. HANSON, A. P. 634.337

The cultivation of lime trees.

J. Jamaica agric. Soc., 1937, 41 : 427-31.

The most suitable situations for limes in Jamaica are rich, well sheltered situations from the coast up to 2,000 ft. with an annual rainfall of over 80 inches. Reduced rainfall, low humidity and exposure to wind are detrimental. It is usual to start a young plantation in the shelter of such plants as cassava, sugar cane, etc., but overhead shade is resented. Any drainage trenching necessary must be done before the young plants are set out. Plants are still usually raised from seed and the method of doing this is described. If budding is resorted to, sour orange should be the stock. Recommended spacing in the plantation:—(a) On steep slopes and poorish soil, 12 ft.×12 ft.; (b) on fairly good flat land, 15 ft.×15 ft.; (c) on good soil with good rainfall, 18 ft.×18 ft. or 20 ft.×20 ft. On a moist land rich in humus an even wider spacing may be advisable. In making the plant holes, which are to be filled with a good compost, it must be remembered that those on clay soils are liable to form water pockets, probably resulting in the plant succumbing to root rot. Such lands should be forked and the compost incorporated so as to form a slight mound. Seedling limes may be expected to bear in the third year after planting; the useful life of a tree is about 30 years. A green manure grown among the trees and periodically cut and used as mulch is markedly beneficial. Pruning consists of removing water shoots and dead branches and removal of weak under branches after the main branches have been formed.

964. F., R.G. 634.337-1.541.11 : 581.144.2

A note of the development of the root system of budded limes after transplantation in St. Lucia.

Trop. Agriculture, Trin., 1937, 14 : 211.

There is a prevalent idea that sour orange has the advantage of providing a deep tap root for limes budded on it. In St. Lucia examination was made of seedling sour orange in the nursery,

3-year-old budded limes on sour orange a few months after transplantation, and 5-year-old limes on sour stock established in the field. The nursery seedlings all had strongly developed tap roots. Of the 3-year-old plants (24) 3 had living tap roots, while the remainder had developed a horizontal root system. Of the 5-year-old trees (110) 3 had living tap roots, all abnormally developed and 107 had developed horizontal root systems. It is evident that in St. Lucia the tap root does not develop after transplanting.

965. HALMA, F. F.

634.334-1.541.12 : 575.252

Important considerations in selection of lemon scion varieties.*Calif. Citrogr.*, 1937, 22 : 493, 506.

Evidence is presented to show that the selection of scions for lemon propagation has an important bearing on tree decline. With sour orange as stock, a scion from a tree of inferior growth character will decline at a comparatively early stage. Scions from a tree of vigorous character on sour orange produce a tree of less rampant growth and greater fruitfulness per unit of bearing surface than when sweet orange is the stock. It is pointed out, however, that weakness in a parent tree may be due to environment rather than inherent. The importance of disease resistance in lemon scion selection is emphasized and differences in constitution and resistance of Villa Franca and Eureka lemons and their sub-strains are discussed. The decline of lemon trees, so widespread in California, is attributed primarily to the propagation of scion strains of low vigour but early and heavy bearing habit. This low vigour is accentuated by the use of the sour orange as a rootstock. Pending a proper evaluation of the numerous scion strains now recognized, propagation should be made from outstanding trees from the locality where the new trees are to grow. Parent trees should be not less than 25 years old, bear fruit of a desirable type, be free from disease and exhibit good balance between vegetative growth and fruit production.

966. HAAS, A. R. C.

634.3-1.84-1.535

Nitrogen in relation to the growth of citrus cuttings in solution cultures.*Plant Physiol.*, 1937, 12 : 163-72, bibl. 5.

Depletion of the supply of nitrogen to tall, rooted, leafy twig cuttings of rough lemon hitherto growing in a complete nutrient solution was followed by a collapse of the root system and loss of leaf. Recovery varying with the degree of injury accompanied the addition of calcium nitrate to the nitrogen depleted cultures. A distinction in appearance is shown between citrus leaves suffering from nitrogen deficiency and those suffering from chlorosis as a consequence of pH. In the former the leaves are pale green and the veins light coloured, in the latter the veins remain dark while the blade becomes yellowish green. The tops of cuttings of lemon grown in solution cultures with ammonium as the only source of nitrogen were larger with increasing concentrations of nitrogen. The growth of cuttings of lemon was greater with increasing concentrations of nitrate as the source of nitrogen. A doubt is expressed as to whether rapidly growing cuttings of citrus can secure adequate supplies of nitrogen from solutions containing extremely low concentrations of this constituent. The growth of cuttings of lemon and Valencia orange was injured by concentrations of nitrite above 5 p.p.m. in culture solutions containing 785 p.p.m. of nitrate.

967. HALMA, F. F., AND EGGERS, E. R.

634.3-1.541.3

Propagating citrus by twig grafting.*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 289-90, bibl. 2.

The method is described by which two twigs are tongue-grafted together and the lower one rooted like an ordinary cutting. Success depends on the use of twigs with healthy mature leaves, maintenance in the propagating frame of high humidity and a sand temperature of 75° F. By this method plants suitable for experimental purposes can be grown in 3 months instead of the 2 years required for budded trees and on a vegetative instead of a seedling stock. The method is also suitable for double working. In the latter case the grafts should have the twig portion shorter than with single grafts while the intermediate may be very short.

968. MATTHEW, A. 634.31 : 382.6
Score card for internal quality factors for oranges.

Citrus Grower, 1937, No. 48, pp. 7-13.

Owing to differences in the climate of different orange growing districts and to differences in the same district in different seasons considerable difficulty arises in applying a single set of minima standards of internal quality to oranges for export. The author considers that the present system whereby the principle of compensating factors is recognized but applied somewhat harshly results in the exclusion of a considerable number of fruits which are perfectly suitable for export. As things are, if fruit is slightly below the minimum for one internal quality factor, e.g. juice content, it must be well above the minimum for two other factors. He suggests that a much fairer application of the principle would be to demand only that fruit which is slightly below the minimum for one factor must not be below the minimum for a second factor and must in addition be well above the minimum for a third factor. He draws up a score card for internal quality factors in which varietal characteristics of the three groups, Navel, Valencias and seedlings are taken into account and the score made according to juice contents, ratios and soluble solids. He considers that the adoption of standards based on these figures, while not making it easier to export poor fruit, would at least reduce the chance of good fruit being turned down.

969. TAYLOR, C. A. 634.3-1.67-1.432
Use of soil-moisture and fruit-growth records for checking irrigation practices in citrus orchards.

Circ. U.S. Dep. Agric. 426, 1937, pp. 23, bibl. 13.

It is shown that with oranges, lemons and grapefruits the onset of water shortage in the soil can be observed by taking daily records of the apparent fruit size increase. A definite decrease in rate of swelling, and finally standstill and even shrinkage of the fruit indicates progressive water shortage. Under such conditions application of water is followed by a marked swelling of the fruit. The records should be taken on selected fruits, at least 10 cm. in circumference, on the N. or W. sides of the tree, early in the morning, to avoid errors through diurnal water fluctuations in the fruit itself. The circumference of the fruit is measured with a flexible steel tape. Tables for conversion of circumference into volume are given. Soil sampling should be carried out in conjunction with studies of the root position. Soil samples give most reliable guidance when taken in soil regions well filled with roots, and at 1 ft. depth or more, to avoid the effect of water loss by evaporation from the soil surface. Examples are given of correlation between soil moisture contents reduced to within the "wilting range", and shrinkage of the fruit. In general, no decrease in fruit swelling is noted at soil moisture contents between "field capacity" and the "wilting range". Exceptions in heavy soils are noted. For best results, water should be applied as soon as the "wilting range" is reached. Growers are urged to use both fruit growth and soil moisture records in their own orchards, and also to follow the water penetration, when irrigating, by use of a metal "probe". This latter, when forced into the soil below the irrigation furrow, shows markedly increased resistance to penetration when it reaches unwetted soil.

W.S.R.

970. ANDERSSEN, F. G. 634.31-1.8 : 664.85.31
Fertilization of Washington Navel oranges. I. Influence on cropping and growth. II. Influence on quality and composition of fruit.

Fmg S. Afr., 1937, 12 : 309-14 and 373-6, 382.

These experiments have been fully reported by the author in the *Journal of Pomology*, 1937, 15 : 117-59, and abstracted in *H.A.*, 1937, 7 : 722. They are now reproduced in a slightly more popular form.

971. ANON. 634.3-1.874
Mulching of citrus trees.

N.Z. J. Agric., 1937, 55 : 74.

In this brief note it is stated that the results of mulching citrus trees over a period of years in the Auckland District are apparent in the smooth-surfaced, dark green foliage and in the smooth

clear skin of the fruit. Since mulching was undertaken the quantities of artificial manures necessary have been reduced by nearly half. The practice is to grow clovers or grass in an adjacent field and place the cut material in late summer round the trees up to the limit of branch spread.

972. SHARP, L. T. 634.3-2.111

Freeze observations and after treatment of citrus orchards.

Calif. Citrogr., 1937, 22 : 394, 416-7, 432-5.

Certain admittedly fragmentary observations made in Californian citrus groves during the frost of January 1937 are discussed. In cover-cropped areas the soil was definitely warmer than that in the cultivated plots. The fruits were slightly colder in the cover-cropped area and definitely slower in warming up. The ice-covered fruits in the sprinkled groves were definitely colder and slower in temperature recovery than any other fruits. Possibly coverage with some other insulating material than ice may be more beneficial. In a 5-acre block under irrigation the air was maintained in a warmer condition than in unirrigated blocks by reason of the heat transference from the water. The rises in temperature provided by the various systems of oil heating are not widely divergent from the theoretical consideration of the facts. Tree treatment of frosted groves is concerned chiefly with fertilization, irrigation, cultivation and pruning. The use of fertilizers, especially nitrogen, has not been greatly modified after frost but should depend on soil rather than on tree condition. After frost damage trees suffering previously from chlorosis and similar ailments should be sprayed with zinc. The rank abnormal growth which often occurs on cut-back trees will usually respond to zinc treatment. Frosted trees should receive less irrigation water owing to the reduced amount of foliage. This may be achieved by reducing the size of the irrigation panels or the number of furrows, according to the system in use. Cultivation should be a "natural" method. Tillage should be reduced to a minimum and cover crop or natural weed be grown throughout the winter and some allowed to grow in summer or through the irrigation period. Disc roughly rather than pulverize the soil. Pruning is the operation most modified by frost effects. Oranges and lemons should have all dead wood caused by the frost cut out and the terminal leaders thinned to avoid congestion as the cut terminals resprout. Whitewashing is recommended in the continued absence of authoritative negative data.

973. WALKER, H. B., AND SCHOONOVER, W. R. 634.3-2.111.35

Orchard heating report made by University of California investigators.

Calif. Citrogr., 1937, 22 : 446, 468.

A note is given of a report on orchard heating in citrus groves prepared by the University of California's division of agricultural engineering. The report contains sections on orchard heaters, fuel oil recommendations, oil distribution systems, recommended practice for orchard heater distribution systems and a technical section on piping system calculations for orchard heater fuels.

974. EDITORIAL. 634.334-2.111 : 537.531

X-ray used to study progress of frost damage.

Calif. Citrogr., 1937, 22 : 495, 496.

The progress of frost damage and granulation, also blossom-end decline in lemons is under investigation by means of the X-ray at the laboratories of the California Fruit Growers Exchange. Selected damaged fruits are photographed every 2 weeks and the internal changes are plainly visible. It is hoped that valuable information will be obtained about the progress of frost damage, granulation and internal decline.

975. WALKER, H. B. 634.3-2.111.35

Orchard heater investigations as made by University of California.

Calif. Citrogr., 1937, 22 : 494, 534, 536-7.

Certain problems of orchard heating are reviewed. In particular, attention is paid to methods of obtaining a maximum heat distribution with a minimum capital outlay, while avoiding the

creation of a smoke nuisance through overdriving an insufficient number of heaters. The influence of atmospheric conditions on the maintenance of an artificially produced temperature is briefly explained. Various types of heaters in common use are discussed.

976. WALKER, H. B., AND SHOONOVER, W. R. 634.3-2.111.35
Recommended practice for storage of oil and distribution systems in groves.
Calif. Citrogr., 1937, 22 : 584, 587-8.

This title forms a part of the University of California's report on oil heating of orchards. In this section the storage of oil on the estate in tanks, which may be of metal or concrete, is considered together with the pumping equipment and pipe line systems necessary if the fuel is to be fed directly to individual heaters or is to be conveyed to hydrants placed at convenient points in the orchard. Controlling design factors for pipe line heater systems are:—(a) a maximum fuel demand of 75 gallons per acre per hour for lemons; (b) a maximum allowable oil viscosity of 120 sec. Saybolt Universal at or below 35° F.; (c) a maximum pressure differential between any two rises in a design block of 20 lb. per sq. in.; (d) a design pressure for any rises of 20 lb. per sq. in. for pump pressure systems and 15 lb. per sq. in. for gravity systems.

977. STREET, E. A. 634.3-2.183
Largest individual owner of citrus acreage in State, A. Wardman, Whittier.
(Windbreaks—Ed.)
Calif. Citrogr., 1937, 23 : 4-5, 34-7.

In an article concerned with the organization and estate practice of certain orange groves it is mentioned that very efficient immediate protection from winds is afforded to young plantations by windbreaks constructed of red wood slats, strongly supported with heavy posts and steel rods. Red wood posts 4×6 in. $\times 27$ ft. are set 3 ft. in the ground in concrete at intervals of 10 feet. The lateral slats are 1×3 in. with a spacing of 3 inches between the slats. An anchor rod of heavy steel is bolted to each upright, the other end being anchored in concrete. Two quarter inch steel guy ropes are also connected to each post. This windbreak is said to be the equal of natural windbreak trees twice the height. The cost in California is 1 dollar 60 cents per linear foot including labour and materials.

978. PARKER, E. R. 634.3-2.19 : 546.47
Experiments on the treatment of mottle-leaf of citrus trees. III.
Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 213-5, bibl. 4.

The experiments recorded here were made on Washington Navel orange trees which formed part of a comprehensive fertilizer experiment started at Riverside in 1927 with 43 different treatments (4 plots each) and 1 treatment of 25 plots. Prior to zinc treatment a yield response to nitrogen and organic matter application had been noted. The zinc treatment given consisted of spraying 4 trees of each plot row of all treatments nearest the irrigation pipe line with 10 lb. $ZnSO_4 \cdot 7H_2O$, 5 lb. $Ca(OH)_2$ and 4 oz. powdered blood albumin spreader to 100 gallons water. Immediate improvement in tree condition resulted and was maintained and yields were greatly improved especially in the 2nd year. It appears evident that zinc treatment is effective on mottle-leaf under a wide range of fertilizer programmes and that mottle-leaf has been an important factor in this orange fertilizer experiment. The uniform treatment of all plots with zinc is believed to be justified as a means of promoting more normal tree behaviour, so that the specific effects of the various fertilizers can be more accurately determined.

979. PARKER, E. R. 634.323-2.19 : 664.85.323
Grapefruit yield, quality as influenced by mottle leaf and zinc treatment.
Calif. Citrogr., 1937, 23 : 14, 16.

Mottle leaf profoundly influences the fruiting capacity of grapefruit trees by reducing the number of fruits matured, while such fruits as are produced are reduced in size, abnormal and so of decreased value. The application of a foliage spray containing zinc compounds resulted in the elimination of the symptoms of mottle leaf with subsequent improvement in quantity, size

and quality of fruit and a return to normal cropping ability. It is apparent that the degree of response to zinc treatment is dependent upon the severity of mottle leaf attack, and that no crop response would be obtained from trees lacking symptoms of this disorder. The experiments were carried out at the Citrus Experiment Station, Riverside, California.

980. REED, H. S., AND PARKER, E. R.

634.3-2.19

Effects of zinc on growth.

Calif. Citrogr., 1937, 22 : 411-2.

The changes in growth in citrus suffering from mottle leaf, which occurred after an application of a spray composed of zinc sulphate 10 lb., hydrated lime 5 lb., water 100 gallons, are described. The existing dwarfed and mottled leaves took on a natural green without increase in size. The subsequent leaves, however, produced in the first cycle of growth after spraying were healthy and of a normal size while improvement was also shown by the longer shoot growth, greater distance between leaves and the presence of blossom. Internally there was no significant difference between the thickness of phloem in twigs from sprayed or unsprayed trees, but the xylem cylinder was seen to be distinctly thicker in the sprayed trees, particularly when the older twigs were compared. An increased cambium activity would logically follow the great increase of chlorophyll-bearing area.

981. BAKER, R. E. D.

634.3-2.411

Gummosis of citrus in Trinidad. III*. Notes on the control of the disease in old plantations.

Trop. Agriculture, Trin., 1937, 14 : 255-6, bibl. 1.

Control methods are described which have been undertaken in 1934 with some success in a plantation of 572 Marsh grapefruit, 28 per cent. being attacked with gummosis. These measures were:—drastic pruning, sometimes amounting to the removal of nearly half the tree and branches 6 inches in diameter; removal of all branches and foliage within 6 ft. of the ground to admit free passage for inspections; the excision of all diseased bark, in extreme cases areas of 3 square feet having been cut out; the opening of clogged drains and 4 general weed cuttings and 4 clean weedings round the trunks per annum. No wound dressings of any kind were used either for the bark or the pruning cuts, thus the wounds could be easily examined and any recrudescence of the disease noted. All diseased trees were inarched with 2 to 4 sour orange plants and this undoubtedly saved a number of trees which otherwise would not have recovered.

982. CALIFORNIA FRUIT GROWERS' EXCHANGE.

634.3-2.411

Brown rot control.

Calif. Citrogr., 1937, 23 : 46.

The Pest Control Bureau of the California Fruit Growers' Exchange state that a spray composed of zinc sulphate 12 lb., copper sulphate 1 lb., hydrated lime 6 lb. with or without a blood or casein spreader has approached in effectiveness against brown rot of citrus (especially lemons) the regular 3-3-50 bordeaux mixture. The spray may be applied up to within a few days of fumigation without risk of burning. This is not the case with bordeaux, the use of which may result in severe damage after fumigation even when the latter is deferred till several months after the spray application.

983. COSTANTINO, G.

632.78 : 634.3

Il *Cossus cossus* L. dannoso agli agrumi. (***Cossus cossus* as a citrus pest.**)

Ann. Staz. Agrum. Frutt. Acireale, 1937, 14 : 199-203, bibl. 2.

In 1936 the larvae of a moth, *Cossus cossus*, were found to be attacking the bark round the root collar of a number of orange and mandarin trees at Gerbini in Sicily. The infestation was actually very slight, only some 50 trees out of 30,000 examined being attacked, and of these

* Part I, Marsh grapefruit on sour orange stock. Part II. The causal organisms. *Ibidem*, 1934, 11 : 236-92, 1935, 12 : 36-42. *H.A.*, 1935, 5 : 98.

only 9 or 10 dying as the result. By clearing away the soil down to the junction with the root it was possible to remove the larvae and allow the scars made by them to heal. It is thought that they may have moved there from artichoke plants on which they were also found and are known to feed. They seem unlikely to become a serious pest.

984. BOYCE, A. M., AND MABRY, J. 634.31-2.73

Greenhouse thrips on oranges.

Calif. Citrogr., 1937, 23 : 19-20, 28, bibl. 3.

Greenhouse thrips (*Heliothrips haemorrhoidalis* Bouché) are slowly extending their range in the orange groves in San Diego county, California. A brief biological study of this pest is given. The fruit injury constitutes a direct loss in that the blemishes on the fruit render it unsaleable. Experiments showed that pyrethrum and dinitro-o-cyclohexylphenol resulted in very high initial kills both in the laboratory and in the field. Rotenone bearing dusts were of low efficiency. None of the materials tried had sufficient residual toxic action to kill the thrips that hatch subsequent to the treatment. A suggested treatment is the inclusion of pyrethrum extract or nicotine sulphate at the rate of 1-1200 in the regular late summer oil spray for scale and citrus red mites. Owing to the very thorough coverage needed for control, the removal before spraying of off bloom fruits which contain the major portion of the thrips population is recommended.

985. BODENHEIMER, F. S., AND STEINITZ, H. 634.3-2.752

Studies in the life history of the citrus mussel scale (*Lepidosaphes pinnaeformis*) in Palestine.

Hadar, 1937, 10 : 153-9, bibl. 6.

An account is given of the life history, seasonal fluctuation, progress of infestation and dispersal of the citrus mussel scale in Palestine.

986. SMITH, A. J. 632.944 : 634.3

Gas concentration.

Fmg S. Afr., 1937, 12 : 333-6.

Comparative studies of various citrus fumigants commonly used in S. Africa are reported. The materials tested were sodium cyanide and sulphuric acid (pot method), liquid hydrocyanic acid, a low grade calcium cyanide of 40-50% purity and a high grade calcium cyanide of 88.5% purity. The results obtained are discussed and tabulated.

987. LACARELLE, F. 634.1/8

L'orientation de la production fruitière du Maroc. (Trend of fruit production in Morocco.)

La Terre marocaine, Rabat, Morocco, 1937, pp. 95.

The economic position of Morocco in the fruit growing world is considered with reference to each of its fruit products. The importance of existing plantations and their actual value to commerce as regards varieties and cultural condition of the plantations are discussed and suggestions are made for suitable varieties for future commercial planting. The author considers that the basis of Moroccan fruit enterprise will always be the orange. The different districts of the country are then individually considered and the fruits most suitable for their particular conditions are suggested. The publication concludes with a very full description of each variety recommended. The publication is amplified with numerous charts and tables dealing with various aspects of marketing and with climatic conditions.

988. PITCAIRN, A. 631.459

Soil erosion in Cyprus.

Cyprus agric. J., 1937, 32 : 35-40.

A summary is given of a report on soil erosion in Cyprus recently issued (as Bulletin No. 4) by the Department of Agriculture. The subject is treated very fully. Measures of control advocated are :—(1) A reduction of sheep and goats to the numbers which the village grazing grounds can normally support. (2) The institution of rotational grazing. (3) Provision of supplementary

feed for the grazing animals during the autumn months. (4) A reduction of the number of goats in the hills. (5) Prohibition of grazing animals on steep cultivated slopes. (6) The prevention of extensive cutting of *Thymus capitata* for fuel. (7) Tree planting in plains and foot hills. (8) The planning of a drainage system in conformity with counter erosion methods. (9) Strip cropping on the contour when the expense of terracing is not justified. (10) Construction of check dams and afforestation to control the flow of streams and torrents.

989. ASAMI, Y., AND CHOW, C. T. 634.451 : 581.162.3

Is the pollen of Japanese persimmons carried by wind?

J. hort. Ass. Japan, 1936, 7 : 247-51, bibl. 4.

Although the fruit of the kaki can develop parthenocarpically, seed formation is closely related to de-astringency in fruits of some non-astringent varieties and influences both shape and early dropping of fruits in certain varieties such as Fuyu. The data discussed here were taken from one 30-year-old tree of this variety at Komaba. Some flowers were left to open pollination, some were covered with bags of wire gauze and some were pollinated artificially. In addition glass slides coated with a mixture of glycerine and albumen were hung round the tree. The fact that no pollen was caught on the slides and that no seed was produced in the bagged flowers indicates that the pollen is not wind borne. Among visiting insects *Halictus subopacus* was the most frequent, honey bees and *Bombus ignotus* were also noted. Nearly half the fruits from the open pollinated flowers were seedless and even in those which contained them fewer seeds were produced than in the fruits from the hand pollinated flowers.

990. TRAUB, H. P., AND MARSHALL, L. C. 634.651-1.535

Rooting of papaya cuttings.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 291-3, bibl. 10.

The application of bottom heat producing a soil temperature of 85°-90° F. had a marked effect in stimulating the rooting cuttings of *Carica Papaya* under glass in solar propagators and in greenhouses. The temperature in the latter was about 75° F. in the day and 66° F. at night, the relative humidity about 90%. The propagation beds were heavily shaded. Significant differences were not observed between varieties or sex forms. The use of root-inducing agents increased the number of roots put out. The usual time required for rooting to begin was one month. The best cuttings are made by entire branches with the solid proximal (basal) swelling attached, and are followed by proximal cuttings with solid basal swelling attached and by distal cuttings. Median cuttings are less easy though not impossible. The best diameter for cuttings is $\frac{1}{2}$ in. to 1 in. Extremes in either direction give poor results. Transplanting (in Florida) was 100% successful, given well-developed roots and good growing weather, but cool damp weather caused loss. Plants from median and proximal cuttings may start with crooked stems but these have always straightened out completely within 3 months. Plants from cuttings behave in every way like seedlings except that they come into bearing earlier.

991. COSTANTINO, G. 632.796

La protezione degli alberi contro l'ascesa delle formiche. (Protection of trees from ants.)

Ann. Staz. Agrum. Frutt. Acireale, 1937, 14 : 223-33.

The author describes trials of magnesium silicate (or talc), magnesium carbonate, and a number of proprietary substances used for banding trees to prevent the ascent of ants. The first two substances, especially the carbonate, are quite satisfactory but need frequent renewal. The proprietary substances varied in efficacy and in resistance to liquefaction in the sun's rays and to rain. The trials lead him to suggest that a most efficacious substance can be made by mixing the following ingredients in the proportions given and smearing on oil paper round the trunks :— powdered copal resin* g. 350, castor oil D (density 0.938-0.940) litres 0.7, beeswax g. 35. The exact method recommended for mixing is described.

* The resin prepared by the author is Manila copal, or Asiatic or Indian copal resin made from *Vateria indica* L. (=*Dammaria orientalis* Lambet).

992. CASSONE, S. A. 634.462
Il carrubo nella economia siciliana. (**The carob (*Ceratonia siliqua*) and its place in Sicilian agriculture.**)

Ann. Staz. Agrum. Frutt. Acireale, 1937, 14 : 205-22, bibl. 19.

Carob growing, which, with increased motor transport and decreased prices, had been gradually decreasing in Sicily, has now been supported by the government to the extent that further elimination of carob plantations has been forbidden. The following points among others are dealt with in this article :—Chief characteristics of the plant and of the fruit ; cultivation and cultural care ; harvesting ; alcohol production ; sugar extraction ; use as fodder ; use in preparation of fruit ethers ; syrups and similar products ; industrial products of the seed ; honey made from carob flowers ; tannic substances ; other products such as rosaries, made from the seed, or baskets, etc., made from the suckers ; marketing. [It may be noted that carobs are exported to Great Britain via Malta.—ED.]

993. DU TOIT, E. 632.954 : 632.51
Prickly-pear eradication.
Fmg S. Afr., 1937, 12 : 411-3.

Several methods of eradication are mentioned apart from the biological control exercised by *Cactoblastes cactorum*. Mechanical eradication with subsequent destruction of the uprooted plants by burying, burning, drying or poisoning can be fairly efficient. In the latter method a spraying of 3% solution of arsenic pentoxide should be given while the heaps are being stacked. Used as a spray on growing plants arsenic pentoxide at 4%, or 1½ lb. to 4 gallons of water, is not wholly effective, as it admits of regrowth, wastes poison and renders the surrounding herbage which catches the spray dangerous to stock. The most effective method is inoculation with arsenic pentoxide (20 lb. per gallon of water) applied to the leaves by means of a special fork and inoculation of the main stem by pouring a little of the solution into a hole made in the trunk. Certain precautions to be taken in handling the highly poisonous arsenic pentoxide and in the disposal of the remains of the poisoned plants are suggested.

TROPICAL CROPS.

994. WILLIAMS, H. B. 621.26 : 633.61
A portable scale for experimental work.
Trop. Agriculture, Trin., 1937, 14 : 61-2.

A description, photographs and a plan are given for the construction of a portable scale used for expeditious weighing of bundles of sugar cane in the field. It should prove to be capable of adaptation to deal with other crops.

995. CHARTER, C. F. 621.26 : 633.61
A mobile scale* for weighing sugar cane on experimental plots.
Trop. Agriculture, Trin., 1937, 14 : 198, bibl. 1.

An account and plans are given of the construction of a mobile scale for weighing sugar cane in the field. The scale is attended by 5 girls who clean and tie the cane into approximately 50 lb. bundles and 3 boys who work the scale and record the weight. Two such scales can keep pace with 10 cutters and can deal with 32 tons in an 8-hour day. The scale is also useful in weighing bulky material such as manures.

996. WORSLEY, R. R. LE G. 632.951.1
The insecticidal properties of some East African plants. III. *Mundulea suberosa* Benth. Part 2, Chemical constituents. IV. *M. suberosa* Benth. Part 3, Variability of samples.
Ann. appl. Biol., 1937, 24 : 651-8, bibl. 5, and 659-64, bibl. 5.

An attempt to isolate from *Mundulea suberosa* bark crystals other than rotenone without the use of alkali failed. Using alkali, rotenone and two sets of crystals were isolated, the first white

* Entirely different to that described in previous abstract.—ED.

and probably a mixture of 1-deguelin and tephrosin and the second yellow and probably dehydro-rotenone, glucoside and alkaloids. It is thought that these crystals originated from a more toxic precursor, the existence of which must be assumed to account for the total toxicity of the sample. In part 3 the variation in the insecticidal properties and of the chemical constituents of *Mundulea* bark in samples of different origins is considered and the method of evaluating the barks discussed. Two types are found, namely smooth- and corky-barked. Dry weather and calciferous soils appear to favour production of rotenone and other toxic principles in the plant. A fair correlation was found to exist between toxicity and rotenone content, the toxicity being about 1·6 times as great as for pure rotenone. [From author's summaries.]

997. WORSLEY, R. R. LE G., AND NUTMAN, F. J. 632.951.1
Biochemical studies of *Derris* and *Mundulea*. I. The histology of rotenone in *Derris elliptica*.
Ann. appl. Biol., 1937, **24** : 696-702, bibl. 1.
 1. Resin-containing cells can be distinguished microscopically in sections of *Derris* roots. Only these cells respond to Durham's test. 2. Rotenone first occurs in small groups of cells in the secondary cortex opposite the protoxylem, when the plant is about 6 weeks old. Thereafter it gradually spreads in scattered groups throughout the xylem parenchyma and cortex. 3. Starch and rotenone do not occur in the same cell; they occur in mutually exclusive groups. 4. It is probable that, in a mature root, all the xylem parenchyma contains either starch or rotenone. 5. The toxic substances other than rotenone probably occur in the same cells as rotenone. 6. The rotenone-containing cells are apparently morphologically unspecialized. [Authors' summary.]
998. SPOON, W., AND OTHERS. 632.951.1
 Her verschil in werkzaamheid van *Derris*- en *Lonchocarpus*-wortel en de onderscheiding van hun wortelpoeders. (**The difference in activity between *derris* root and *lonchocarpus* root.**) [English summary.]
Ber. HandMus. kolon. Inst. Amst. **110**, 1937, pp. 26, being reprinted from *De Indische Mercuur*, 5 May, 1937, p. 259, and 12 May, 1937, p. 275.
 Eight sets of powders consisting of 1 *derris* and 1 *lonchocarpus* powder each, of equal rotenone content and ether extract, were mixed with diatomaceous earth to obtain dusts with definite amounts of rotenone ($\frac{1}{2}$, $\frac{3}{4}$ and 1%) and used against specific insects. The insects were larvae of *Lophyrus pini* L., *Myrmica rubra* L., and *Euproctis chrysorrhoea* L. The results, which are shown diagrammatically, show that the effect of *derris* dust on larvae of *E. chrysorrhoea* and of *L. pini* is about $1\frac{1}{2}$ times stronger than that of *lonchocarpus* dust and on larvae of *M. rubra* twice as strong. It is found that the two dusts can easily be distinguished by their starch grains. Exact descriptions and illustrations of the grains are given. For 1,063 measured grains of *derris* starch the average length is $6.38\mu + 0.1\mu$ and for 1,197 grains of *lonchocarpus* starch $9.80\mu + 0.2\mu$.
999. GEORGI, C. D. V. 632.951.1
Note on the ether extract of *Tephrosia Vogelii*.
Malay. agric. J., 1937, **25** : 300-1, bibl. 2.
 The ether extract of prunings of *Tephrosia Vogelii* from the Tanah Rata Experiment Station, Malaya, proved to be very low compared with that of a high-grade root of *Derris elliptica* Changi No. 3, i.e. 5.95% compared to 27% calculated on a moisture-free basis. Attention is called to this comparison in view of the somewhat optimistic statements of the value of *T. Vogelii* which appear in the press from time to time.
1000. GEORGI, C. D. V. 632.951.1
The toxic content of haiari or cubé root.
Malay. agric. J., 1937, **25** : 334-7, bibl. 3.
 Black haiari (*Lonchocarpus chrysophyllus* Kleinh.) and a white haiari (*L. Martynii* A. C. Smith sp. nov.?) grown from cuttings were analysed for determination of rotenone content and ether

extract in an attempt to correlate variation in toxic content of root with age of plant. *L. Martynii* produces root in greater abundance than *L. chrysophyllus* and derris plants of similar age (2 years). Between 2 and 4 years *L. Martynii* exhibits only a small increase in root development. In view of the high yield of root the toxic contents of both species of haiari are disappointingly low and neither could be favourably compared with high grade derris. *Lonchocarpus Nicou*, the species apparently richest in insecticidal constituents, cultivated extensively in S. America, was not examined through lack of material.

1001. DE SILVA, C. A. 631.874 : 631.53 : 633.912

Notes on the propagation of *Pueraria phaseoloides*.

Quart. Circ. Ceylon Rubb. Res. Scheme, 1937, 14 : 16-8.

Pueraria phaseoloides appears to be a leguminous ground cover capable of persisting in mature rubber areas without periodical manuring. In establishing such cover on the Dartonfield Estate (the property of the Research Scheme) the following methods of propagation were used. *Marcotted cuttings*. A mixture of good earth and cattle manure was attached with pieces of sacking to fairly mature stems near the root nodes at the beginning of the wet season. Rooting occurred in 4 to 6 weeks, when the resulting plants were detached and planted out as rooted cuttings. This method proved the most satisfactory. *Seed grown in coconut husks*. Seed was sown in coconut husks packed with good soil and cattle manure and laid on the ground under shelter. Many of the seedlings which resulted were fit to plant out in 3 months. An attack by snails was quelled with the aid of a poison bait of sodium arsenite and lime. *Direct distribution*. Seeds were dibbled in small quantities into beds 3 feet square cut centrally between each four trees, and surrounded by a trench to exclude *Hevea* roots. This type of bed was used for all the plantings but the method of direct sowing was least satisfactory because of poor development after germination. A manure made up of bone meal 3, saphos phosphate 2, nitrate of potash 1, nitrate of soda 1, was given at the rate of 1½-3 oz. per bed and as a standard dressing at the latter rate when required. After the plants have spread beyond the beds an application of mineral phosphate at the rate of 100 lb. per acre would materially assist in establishing the cover.

1002. TOBACK, L. 631.871

L'autoépuration biologique des détritus organiques. (Biological autosterilization of organic refuse.)

Bull. agric. Congo belge, 1937, 28 : 112-21.

The method of the biological sterilization in zymothermic cells of organic refuse is described. The residue after sterilization yields a rich manure. The method is discussed in this paper from the standpoint of its applicability to refuse destruction in native villages in the Belgian Congo with the object of providing an alternative to the unsavoury, possibly dangerous, rubbish heaps which otherwise accumulate.

1003. GREIG, J. L. 632.954

The use of chemicals for the eradication of lalang grass.

Malay. agric. J., 1937, 35 : 363-9, bibl. 5.

Infestation of land by lalang grass (*Imperata arundinacea*) renders it useless for agricultural purposes. The grass at the Serdang Experiment Station has recently been extirpated during both the wet and the dry seasons by spraying with 10 lb. sodium arsenate to 55-60 gallons of water per acre at 7-day intervals. Control was obtained in from 5-10 sprayings. The soil was able to support self-sown weeds almost immediately and trees growing on the sites were uninjured. Sodium chlorate proved ineffective. The cost under suitable conditions should be 25 dollars (Straits) per acre, as against 40 to 50 dollars, the cost of hand digging.

1004. SIMMONDS, H. W. 632.5 : 632.96

The biological control of the weed *Clidemia hirta*.

Agric. J. Fiji, 1937, 8 : 37-9.

The successful control in Fiji of the exotic weed *Clidemia hirta* by the introduction of the thrips *Liothrips urichi* from Trinidad is described. Accidentally introduced from S. America about

1880 this weed rapidly covered large tracts of country, forming, often to the exclusion of all other vegetation, dense matted growth 5-6 ft. high, through which the cattle were only able to keep open narrow tracks. That the thrips was not able to suppress the weed in other countries was because of the heavy pressure of other enemies : these, however, were successfully screened out on its introduction to Fiji so that its spread has been unrestricted. As a result the plant is no longer "The Curse", as it was named, it is scarcely a weed.

1005. WEBER, N. A. 632.796
The biology of the fungus-growing ants. *Part II. Nesting habits of the
bachac (*Atta cephalotes* L.).
Trop. Agriculture, Trin., 1937, 14 : 223-6.

An interesting account is given of the biology of the fungus-growing leaf-cutting ant, *Atta cephalotes*, which has a wide range in the western tropics. Founded by a single egg-laying queen provided with a pellet of fungal hyphae carried in the infrabuccal pocket a colony may eventually come to occupy a considerable area. The incessant defoliation of the surrounding vegetation makes these large colonies of economic importance, since they completely strip the surrounding vegetation and prevent its regeneration.

1006. ADAMSON, A. M. 632.732
Preliminary report on termites and termite damage in Trinidad, West Indies.
Trop. Agriculture, Trin., 1937, 14 : 141-9, bibl. 8.

Brief notes are given on the occurrence, habits and probable genera of the termites of Trinidad, so far as determined. A preliminary survey of the damage caused by termites has been made. Control measures applicable to local conditions are outlined.

1007. WOOD, R. C. 633.492
Sweet potato experiments.
Emp. J. exp. Agric., 1937, 5 : 231-8, bibl. 6.

The experiments on which this paper is based were carried out during a period of about 10 years at the Imperial College of Tropical Agriculture, Trinidad. The soil is a slightly alkaline sandy loam deficient in available potash and slightly deficient in available phosphate. In the varietal trials Black Rock proved superior to others in yield, keeping quality and flavour. Red Nut and Jackson have good flavour but poor keeping qualities. Conclusive results in methods of planting were not obtained. A comparison of ridge-planting with flat-planting and subsequent ridging showed that ridge-planting produced the highest yield. A series of spacing experiments indicated that a wide latitude of planting distance is permissible. The only conclusive result of manurial trials is to show the value of pen manure, especially in a dry season.

1008. UPPAL, B. N., AND KULKARNI, N. T. 633.524.1-2.48
Studies in *Fusarium* wilt of sann-hemp. I. The physiology and biology of
***Fusarium vasinfectum* Atk.**
Indian J. agric. Sci., 1937, 7 : 413-42, bibl. 36.

An account is given of the disease and causative organism of a destructive wilt of sann-hemp (*Crotalaria juncea* L.) which has broken out on the Deccan Canals. The disease, attributed to *Fusarium vasinfectum* Atk. is of economic importance, since sann-hemp is a rotational green manure of great value yielding 30,000 lbs. of green dressing per acre. It is also used for renovating waste land and on good lands for encouraging fertility of the soil and for preventing damage from heavy irrigation. Experimental evidence shows that *Fusarium* wilt in sann-hemp is normally transmitted externally on the seed and to a very small extent within the seed as dormant mycelium. Results on the isolation of a wilt-immune type and on the inheritance of resistance will form the subject of a separate paper.

* Part I. New forms. To be published in the *Revista de Entomologia* (Rio de Janeiro).

1009. CALVINO, M. 633.526.42
 L'oro verde dell'oltre Giuba. Una Sansevieria gigantesca da fibre tessile.
 (A gigantic fibre-yielding sansevieria.)
Ital. Agric., 1937, 74 : 249-54.

The author describes the habit of *Sansevieria Stuckeyi* and its possibilities as a fibre plant in the tropics. It can be propagated by seed, by division, by pieces of rhizome and by leaf cuttings, the last method being normal. The cuttings are detached from the plant either by tearing or by cutting and are then dried in the open under shade for 15-25 days before planting in a sandy, well shaded bed. A sandy but deep soil well provided with nutrients is best and should be well worked before receiving the rooted cuttings. Planting is done in furrows 1·2 metres apart, 50 cm. between plants. These furrows should be 25 cm. deep and the roots should be covered with only 15 cm. of soil so as to leave the furrow somewhat open to help in the absorption of rain. During the first four years weeds must be checked and it is recommended that intercropping should be done with leguminous seed plants and grain crops alternately. After the 4th year each plant should yield a mature leaf every six weeks. These leaves will give a commercial fibre content of 5%. It is estimated that the yield per hectare per year should be about 7,360 kg. (or nearly 3 tons per acre). The fibres are very long, 100-120 cm. A few notes are given on processing.

1010. HILL, A. G. 633.61 : 581.162.3
 A note on the method for emasculating sugar-cane flowers by means of an aspirator.

Trop. Agriculture, Trin., 1937, 14 : 128.

A small drawn glass jet is connected by a length of rubber pressure tubing to the intake of a car wind-screen wiper, a vacuum flask being interposed in the pipe line to equalize suction and to trap the anthers and pollen drawn in. The engine is set running, and emasculation can be carried out at considerable speed by running the glass jet methodically along the inflorescence. The jet size and rate of suction can be adjusted so as to break anther filaments and remove the anthers with very little damage to stigmas. The apparatus could doubtless be adapted to suit other varieties of plants. It was originally used with clover. A photograph illustrates the method clearly.

1011. FAIRWEATHER, J., AND YAP, S. T. 633.683 : 664.273
 The sago industry in Malaya.
Malay. agric. J., 1937, 25 : 329-33.

The 2 important species of sago palm present in Malaya both in cultivation and in a half wild state are the smooth-sheathed *Metroxylon Sagu* in the west and the dwarfer, spiny-sheathed *M. Rumphii* in the east. A description is given of the methods of preparing the sago, the palms being harvested when about 12 years old with trunks 12-18 in. in diameter. The palm grows on swampy soil and can be propagated from suckers, though seeds are usually more satisfactory.

1012. OPSOMER, J. E. 635.23 : 631.535
 Note sur le mode de plantation des boutures de manioc. (Experiments in methods of planting cassava cuttings.)
Bull. agric. Congo belge, 1937, 28 : 131-4, bibl. 3.

Cuttings of cassava taken from the lower parts of the stem were planted vertically, horizontally and obliquely. All rooted equally well. The choice of method, therefore, may depend on other considerations. *Vertical method*. With careless native cultivators the danger of inversion is real. Inverted cuttings make sickly plants. Too deep planting makes harvesting more difficult and reduces yield. A planting depth of 15 cm. compared with 5 cm. reduced root production by 6·5% and the yield of starch by 13·2% per hectare. *Horizontal method*. Depth 5 cm. A larger number of shoots result but of a thinness which renders them unsuitable later for use as cuttings. Cultivation is also made more difficult. *Oblique method*. This method is

to be preferred. The cuttings are placed quasi-horizontally so that inversion matters less, the butt end 5-6 cm. below the soil, the upper end protruding 4-5 cm. above it, but with its lower face in contact with the ground. When the plants are knee-high they are lightly cut back.

1013. MARSH, T. D. 633.71
Tobacco experiments at the Central Experiment Station, Serdang, 1933-5.
Malay. agric. J., 1937, 25 : 318-28, bibl. 6.

A fertilizer mixture composed of calcium cyanamide 1 cwt., basic slag 3 cwt. and sulphate of potash 1 cwt. gave satisfactory results. A 50 per cent. increase in quantities gave no significant increase in yield. Indications were obtained that a higher proportion of phosphates to nitrogen and potash would probably produce a better balanced fertilizer for Malaya. The climate, however, is not considered suitable for producing a high grade cigarette tobacco, and future experimental work will concentrate on the production of leaf suitable for pipe and cheroot tobacco.

1014. PRUTHI, H. S., AND SAMUEL, C. K. 633.71-2.8
Entomological investigations on the leaf-curl disease of tobacco in North Bihar.
Indian J. agric. Sci., 1937, 7 : 659-65, bibl. 16.

Negative results were obtained in attempts to transmit A, B, C, and X types of tobacco leaf-curl by the capsid *Engytatus tenuis* Reut. Using much the same technique the A type of leaf-curl was transmitted to tobacco through the agency of the white fly (*Bemisia gossypiperda* M. & L.) taken from sann-hemp plants (*Crotalaria juncea*) badly affected by leaf-curl. Thus sann-hemp can be regarded as an alternative host for this virus. Reverse infections or infections from diseased to healthy tobacco by the aid of *Bemisia gossypiperda* M. & L. are yet to be made.

1015. PAL, B. P., AND TANDON, R. K. 633.71-2.8
Types of tobacco leaf-curl in Northern India.
Indian J. agric. Sci., 1937, 7 : 363-93, bibl. 20.

Working with the cigarette tobacco variety, Pusa H.142, 5 different types of leaf-curl could be distinguished of which leaf-curls A, B, C and D are thought to be due to distinct viruses and X to a mixture of two or more viruses in different combinations. Infection occurs chiefly after transplanting and continues in varying degree throughout the season. The symptoms of the various types of curls are described and the incidence and epidemiology of leaf-curl were studied. Possible control measures are discussed, including the weeding out of diseased plants and their replacement by healthy ones, protection of nurseries from insect vectors and the breeding of resistant varieties. This last offers the most hopeful solution.

1016. BAGOT, A. G. D. 633.72-1.8
Composting tea estate wastes.
The Times of Ceylon Co., Times Building, Fort, Colombo, 1936, pp. xvi+24, bibl. 6, Rs. 4.00.

The vegetable wastes available are fallen leaves from the tea bush, leaves from the pruned branches, tipping leaves not used for manufacture into tea, weeds, ferns, refuse tea and wood ashes. The necessity is discussed of using in addition the following substances:—(1) Cattle dung, and urine earth—this, in the author's opinion, should generally be unnecessary owing to the already high N content of the tea wastes already used. (2) Wood ashes and lime. The first of these should be added as available and the acidity should be further neutralized by lime. It is suggested that 4 lb. wood ash +10 lb. slaked lime might be used per ton heap. (3) Phosphates. The addition of bone meal or other form of phosphate may be desirable. (4) Fungus inoculant. The addition of this is a safeguard but not an essential. As regards manufacture all steps must be taken to conserve nitrogen. All vegetable materials should be well mixed so that the mixture of soft and hard materials will afford optimum conditions for moisture and aeration. The turning of the heap two or three times should ensure aeration and any moisture deficiency can

be made good at that time. Under the moist Ceylon conditions the trenches prescribed in Howard's original Indore method are not so desirable and are in fact liable to get waterlogged and lead to anaerobic conditions. As regards weight of product the weight of the original green material will probably be reduced by about two-thirds. Suggestions are given on the amounts and proportions of the different wastes to be used and the actual formation and routine treatment of heaps with notes on temperatures. In his last section the author considers the costs incurred in making and in application and the manurial value of the compound formed and used. This is an expensive booklet but its contents should prove useful to those interested, especially to planters.

1017. CHANDHURI, H., AND OTHERS. 633.72-2.4

Diseases of the tea bush in the Kangra Valley, Punjab, I.

Indian J. agric. Sci., 1937, 7 : 565-73.

The following diseases of the tea plant from the tea gardens in Polampur (Kangra) are described. (1) Grey blight (*Pestalozzia Theae*), (2) Brown spot (*Phoma theicola*), (3) Brown blight (*Colletotrichum Camelliae*), (4) Scabbing of leaves being the combined effects of the 3 above mentioned diseases, (5) Copper blight (*Guignardia Camelliae*), (6) Internal root disease (*Botryodiplodia Theobromae*), (7) A stem disease (*Hendersonia theicola*), (8) Red rust of tea (*Cephaeleros mycoidea*). The greatest loss in this area is caused by grey blight and brown blight. All the leaf diseases are illustrated in colour.

1018. COURCELLES, J. 633.73

Établissement d'une plantation de café arabica au Kivu. (Establishing an arabica coffee plantation at Kivu.)

Bull. agric. Congo belge, 1937, 28 : 302-17.

An account is given of the establishing of a coffee plantation at Kivu, Belgian Congo, from the first clearing of the ground to the marketing of the crop. Propagation is by seed sown in nursery beds under lath or mat shades, and care must be taken not to remove these too soon or the seedlings will turn yellow and die, a fortnight before transplantation to the field being soon enough. Thinning takes place when 2 pairs of leaves have developed, either by transplanting to a nursery and spacing the plants 25 per sq. m., or by weeding out to about 50 plants per sq. m. The most suitable age for transplanting to permanent positions is 6 months. *Tephrosia Vogelii*, planted 3 m. apart from seed and renewed every 2 or 3 years, is used as a shade tree. The young coffee bushes, with ball of soil attached, are planted 3-4 m. apart in specially prepared holes. A leguminous cover crop for subsequent digging in is usual. Belts of leguminous plants are also used as shelter hedges and for the prevention of erosion. Pruning begins when the plants are about 1.30 m. high and consists chiefly in removing the suckers and in heading back the tree. The first crop is usually borne when the tree is 2 years old.

1019. NUTMAN, F. J. 633.73 : 581.132

Studies of the physiology of *Coffea arabica*. 1. Photosynthesis of coffee leaves under natural conditions.

Ann. Bot., Lond., 1937, 1 : 353-67, bibl. 11.

A method is described whereby the rates of uptake of carbon dioxide by leaves of *Coffea arabica* still attached to the tree can be measured over short intervals of time. Data are presented for the apparent assimilation of coffee leaves under field conditions and are compared with the assimilation rates published for other plants. Both high and low light intensities reduce the assimilation rate of coffee, the greatest assimilation taking place under a moderate light intensity; the total daily assimilation is greater in the shade than in the sun. The midday drop in assimilation rates during sunshine cannot be explained by the water relations of the leaf nor by the possible accumulation of assimilates, but could be explained by variation in rate of ingress of carbon dioxide to the leaf due to stomatal movement. This hypothesis is developed in another paper [See abstract 1020]. Additional observations made during the work are summarized. An increase in the water supply to the roots of coffee does not affect the assimilation rate or the

midday assimilation drop during sunshine. One leaf left exposed after all the remaining leaves on the tree (possibly some 5,000) have been placed in darkness does not alter its behaviour. The effects of shade on assimilation of a leaf is the same whether the leaf alone or the whole tree is shaded. A horizontal leaf in midday sun ceases assimilation but, if turned edgeways to the incident light, assimilation at once starts. A horizontal leaf exposed to full sunlight for 16 hours and assimilating at an appreciable and increasing rate will show decreased assimilation, if turned so as to be normal to the incident light. Assimilation rates can change with great rapidity; a table is given showing the rapid changes in the photosynthetic rates determined at 2-minute intervals during rapidly alternating sunshine and shadow. The work was done on trees growing in the coffee districts of the Northern Province, Tanganyika.

1020. NUTMAN, F. J. 633.73 : 581.132

Studies of the physiology of *Coffea arabica*. II. Stomatal movements in relation to photosynthesis under natural conditions.

Ann. Bot., Lond., 1937, 1 : 681-93, bibl. 11.

Stomatal movements of *Coffea arabica* growing in the Northern Province, Tanganyika, are shown to be due to the direct action of radiation on the stomata and not to the water relations of the leaf. (In coffee, light in excess of a value of about 0.9 gm. cals./cm.²/min. leads to stomatal closure.) The numerous points of similarity between movements of the stomata and changes in the photosynthetic rate enable the variations in assimilation to be explained by the hypothesis of stomatal control. [See previous abstract.]

1021. STOFFELS, E. 633.73-1.542

La taille du caféier *arabica* au Kivu. (Pruning *arabica* coffee at Kivu.)

Publ. Inst. nat. Étude agron. Congo belge, sér. tech., 12, 1937, pp. 35, bibl. 5.

The author gives instructions for pruning *arabica* coffee both during its juvenile period and later and illustrates the methods advocated with clear diagrams. He deals in turn with the systems whereby 1, 2 or 3 main stems are used as framework, next the system by which the young plant is bent over on reaching a height of about 31 inches and attached to a stake close to the ground, where it is held until three or four shoots have formed close to its basal end and are growing strongly, whereupon it is severed just beyond the point where the fourth shoot issues. Lastly he briefly describes the Agobiada system whereby the original stem is bent over when about 39 inches high and kept in that position. He next proceeds to give instructions for normal routine pruning, the aim being to ensure adequate light and air over the bearing area. With the aid of diagrams he shows clearly what pruning should be done in a number of ordinary cases with which any planter is likely to be faced and he discusses the reasons for the pruning advised.

1022. BECKLEY, V. A. 633.73-1.86

Cattle manure : is it harmful to coffee ?

J. Mysore agric. exp. Un., 1936/37, 16 : 222-5, reprinted from *Mon. Bull. Coffee Bd. Kenya*, 1937, 3 : 25.

This is a discussion of the statement appearing in the *East African Standard* on 1 January, 1937, by Mr. R. A. Clay of Donyo Sabouk, that the heavy application of cattle manure to portions of his coffee plantation had adversely affected the quality of the coffee with consequent lowering of price without any compensating increase in yield. Mr. Beckley, Senior Agricultural Chemist, Kenya, accepts the statement and attributes the loss in quality to an unbalancing of the internal economy of the tree by the preponderance of nitrogen in such manures. If phosphates are consistently combined with the cattle manure an improvement in quality will most probably be observed. The fact that Mr. Clay's trees have suffered very little die back compared with many other plantations and have cropped regularly may be attributed to the use of this cattle manure.

1023. MAYNE, W. W. 632.44 : 633.73

Factors affecting spray success in the control of coffee leaf disease.

Bull. Dep. Agric. Mysore Coffee Exp. Sta. 15, 1937, pp. 48, bibl. 7.

The paper gives an account of the distribution of leaf growth on *Coffea arabica* in Mysore, the activity of leaf disease (*Hemileia vastatrix* B. & Br.) and some of the factors involved in its control. Sixty per cent. of the total leaf growth occurs during the hot weather flush from March to May and a secondary and rather variable flush is resumed in August continuing from then on through the north-east monsoon to November. Disease activity begins with the hot weather showers. Optimum protection is achieved by spraying when the leaf is a month old. Evidence of the value of a further spray in September is incomplete but indicates at present a certain benefit from a second spray, particularly when the disease is late and light. The aim of the control measures should be to reduce the centres of infection carried through the dry weather, to adjust the spraying to the times of maximum leaf expansion combined with its suitable age and to complete the spray rounds with rapidity. Certain recommendations are made as to the adjustment of spray times within the limits set by practical considerations. There are indications that pruning before "blossom showers" and the use of additional sprayings under certain circumstances may be beneficial.

1024. MYSORE STATE DEPARTMENT OF AGRICULTURE. 632.76 : 633.73

The coffee stem borer and its control.

Circ. Dep. Agric. Mysore St. 57, 1937, pp. 5.

The coffee stem borer (*Xylotrechus quadripes* Chevr.) ranks as the most serious pest of coffee in Mysore. Control measures suggested are:—burning all borer infested coffee stems by the end of August and prevention of their storage for fuel by the labourers; scrubbing the coffee stems in October-November to remove eggs and young grubs; painting the coffee stems with an emulsion of high boiling, coal or wood tar distillate, which has both ovicidal and larvicidal properties and a deterrent effect on egg-depositing adults; it is not suggested that every coffee bush on the estate should be so painted but only those on borer infested patches and a few hundred of the surrounding bushes. The emulsion could be used in the scrubbing treatment already outlined.

1025. SHEPARD, C. Y. 633.74-1.4

The cacao industry of Trinidad. Some economic aspects.

Series III. An examination of the effects of soil type and age on yield.

Series IV. Recommendations for improving the efficiency of estates.

Govt. Printing Office, Port of Spain, Trinidad, 1937, pp. 30-101 + 25 maps, bibl. 24.

The decline in exports of cacao from Trinidad and Tobago is in part due to a decline in individual tree yield which increases with the age of the tree. The decline appears to begin sooner on poor soils than on good soils. Yield of the field is decreased by cumulative casualties among the better bearing trees, retarded by the rising yields of the survivors on good soil, and accelerated by the falling yields of the survivors on poor soil. No traditional methods of cultivation will restore these declining fields on poor soil to their former level, though the new methods recommended in Series IV may raise the yields of good fields beyond their previous maxima. The author compares in detail the yields of fields of the same age on different soil types in a single district and shows the importance of soil type in determining the relative magnitude of the yields, profitability and duration of the economic lives of the various fields. From an examination of the records of fields of different ages on each of the more important soil types it is seen that whereas on a good soil a profitable yield may be maintained for 80 years, on a poor soil it may decline within 45 years to a level that would be unprofitable at the highest price of cacao recorded for the past 70 years. Some of the yield depressing factors associated with age can be counteracted, others cannot. Recommendations for raising the efficiency of estates are briefly:—Amalgamation of estates as limited liability companies to ensure greater financial

stability, permitting amongst other things the employment of efficient resident managers at commensurate salaries; the keeping of a record of expenditure and return from each field; the retention of labourers permanently on the estate independently of seasonal requirements and, to ensure this, the introduction of some profitable subsidiary crop such as rubber complementary to cacao in its seasonal labour demands is suggested, together with the provision of house sites (at a rental) on which the more industrious labourers would erect their own dwellings; and lastly the abandonment of unprofitable cacao fields including inherently unfertile areas lying within good bearing fields. The advantages and disadvantages of replanting are discussed and contrasted with rehabilitation by replacement of poor by high bearers, the latter course being preferred. How this can be done with least disturbance to financial resources is outlined.

1026. HARDY, F., AND OTHERS.

631.4 : 633.74

Studies in West Indian soils. X. The cacao and forest soils of Trinidad. (B) South-central district.

The Imperial College of Tropical Agriculture, Trinidad, 1936, pp. 56, bibl. 14.

The origin and composition of the main soil types met with in the Penal, Siparia, Basse Terre and Moruga district are fully discussed. Undesirable features of some of the clay soils are attributed to a high content of exchangeable magnesium in relation to the content of exchangeable calcium. The development of the soil profile to its present state is described and traced. Seven distinct types of forest vegetation are recognized, ranging from that occurring in swamp land to that which arises when other types of forest have been cleared or when cultivations are allowed to revert to bush. The particular importance of rainfall, topography and soil is stressed in relation to their relative effects on the distribution of forest types. Water availability as affected by soil structure and slope, rainfall and nature of vegetation is considered. Two maps, one of vegetation and crops and the other of the soil, conclude the study.

1027. VOELCKER, O. J.

633.74 : 581.162.3

Self incompatibility in cacao.

Sixth annu. Rep. on Cacao Research for 1936, I.C.T.A., Trinidad, 1937,
pp. 2-5, bibl. 19.

An outline is given of the work which is being undertaken on the incidence of self-incompatibility in cacao and on the allied subject of cross-fertilization. An attempt was made, working with the Imperial College Selection trees, to obtain further information on the periodical change from self-incompatibility to self-compatibility supposed to take place in certain trees. As a result of the measures taken it was possible to divide the trees into self-compatible and self-incompatible, the number of the latter being surprisingly large. The covered self-incompatible flowers did not set fruit except very occasionally, but on the portions of the self-incompatible trees not covered for hand selfing fruit was set freely, presumably as the result of cross-pollination from neighbouring trees by an unknown agent. This assumption is now being tested by study of axil spot inheritance and bean colour and so far has produced no contradiction to the assumption postulated. No periodical change from compatibility to incompatibility or *vice versa* could be traced during the period of observation. The reason for the much higher yields in Nigeria is discussed. The proportion of fruit remaining after 14 days of pollination between Nigerian trees and certain self-compatible Trinidad trees is about the same. The cultural methods of the West Coast can hardly be so greatly superior to estate practice in Trinidad and the justifiable conclusion is reached that there are factors limiting yield inherent in many Trinidad trees which are partially or totally absent from West African trees. Such a factor may be the incidence of fertilization. Supposing the 13 incompatible I.C.S. trees (out of a total of 17 all told) had not been surrounded by trees whose pollen was compatible to them, presumably they would have been classed as poor yielders. This possibly must be borne in mind when planting up fields of clonal cacao. Again, if the pods on the self-incompatible trees are the results of mixed parents, trees raised from such seeds would probably show a high proportion of self-incompatibles, assuming this character to be of genetic origin. The cacao bean, too, exhibits xenia which remains in the commercial product, thus the colour of the bean in self-incompatible trees may be

altered by the character of male parent from pod to pod on the same tree while the colour of the pod will remain uniform. No definite conclusions are reached in this article, the investigations being still in progress.

1028. HARDY, F. 633.74-2.115
Marginal leaf scorch of cacao. Its relation to soil potash deficiency. (With a note on the ecology of cacao thrips.)
Sixth annu. Rep. on Cacao Research for 1936, I.C.T.A., Trinidad, 1937, pp. 13-24.

Marginal leaf-scorch of cacao, known to planters for many years, has been identified with a deficiency of available soil potash or lack of nutritional balance, especially in regard to the uptake by the tree of potassium, calcium and nitrogen. The methods used in obtaining the evidence were sand pot cultures of cacao seedlings, sand tub cultures of cacao cuttings, soil surveys, and cacao leaf chemical analysis. Contributing factors were found in an unsatisfactory soil structure affecting the water relations of the soil, and an atmospheric exposure conducive to desiccation of soil and plant. Limiting values for available potash content of soil supporting healthy cacao trees from leaf scorch appear to range according to texture type from 100-175 p.p.m. exchangeable potash. Analytically leaves liable to scorch are differentiated from healthy leaves by high nitrogen-potash ratio, low potash-lime ratio, high ash content, low soluble ash and total base content, and low gross content of nitrogen and potash. Thrips attack is constantly associated with leaf scorch. In each case unsatisfactory environmental conditions cause pronounced leaf desiccation, which may be only temporary in the case of susceptibility to thrips but permanent in the case of leaf scorch. The problems of the amelioration of leaf scorch by suitable manuring and soil structure improvement are briefly discussed.

1029. HARDY, F. 633.74-1.8
Manurial experiments on cacao in Trinidad : 1932-1936.
Sixth annu. Rep. on Cacao Research for 1936, I.C.T.A., Trinidad, 1937, pp. 24-34.

Manurial experiments are described which have clearly revealed the nutrient requirements of 3 distinctive types of cacao soil in Trinidad. The chief deficiency in all 3 types is in available phosphate, while one type (acidic river alluvial sandy soil) is usually deficient in available potash. The experiments were designed to test (1) the interactions between phosphatic and potassic manures, (2) the relative value of different kinds of phosphatic manures, (3) the profitability of artificial manuring at current cacao prices, (4) effects of nitrogenous manure (ammonium sulphate chiefly) on benefits derived from phosphatic and potassic manures, (5) depressing effects of gypsum on manurial benefits, (6) relative effect of shade and no shade on manurial benefits, (7) effect of mulch on manurial benefits, (8) relative value of sulphate and muriate of potash. In general exceptionally large responses have been obtained by suitable artificial manuring. [From author's summary.]

1030. McDONALD, J. A. 633.74 : 581.48 : 581.192
A preliminary investigation of the biochemical attributes of quality in fresh cacao beans.
Sixth annu. Rep. on Cacao Research for 1936, I.C.T.A., Trinidad, 1937, pp. 34-40, bibl. 2.

Analytical results disclosed considerable variation in the tannin and theobromine content of fresh cacao beans from different types of pod. Definite correlations between tannin, theobromine and fat content for different botanical types of cacao could not be established, possibly because of limited material which had in addition matured under abnormal climatic conditions. Further investigation may be necessary to prove whether or not tannin, fat and theobromine are factors deciding quality.

1031. McDONALD, J. A. 633.74-1.56 : 663.917 : 675.042
The effect of fermentation on the biochemical composition of different types of cacao bean.
Sixth annu. Rep. on Cacao Research for 1936, I.C.T.A., Trinidad, 1937, pp. 40-2,
 bibl. 6.

A decrease in the theobromine content of the kernel of the bean and a corresponding increase in the theobromine content of the shell during fermentation was observed. The theobromine content of the kernel of fresh cacao beans may furnish a useful index of botanical type while the theobromine content of the shell of fermented beans may prove a useful index of the duration of the fermentation process. Fermentation appears to cause an increase of tannin in the kernel. The rôle of tannins in relation to quality is discussed.

1032. McDONALD, J. A. 633.74 : 663.917
A note on the estimation of theobromine in cacao beans.
Sixth annu. Rep. on Cacao Research for 1936, I.C.T.A., Trinidad, 1937, pp. 43-4,
 bibl. 2.

A better extraction of theobromine (40% increase) was obtained by the use of a modification of the Soxhlet method of continuous extraction than by Wadsworth's method as published. The technique employed is described.

1033. McDONALD, J. A. 633.74 : 675.042
The tannins in cacao beans.
Sixth annu. Rep. on Cacao Research for 1936, I.C.T.A., Trinidad, 1937, pp. 44-8,
 bibl. 9.

Of 3 methods of analysis applied to the determination of tannin in fresh cacao beans a modification of the cinchonine sulphate method is the most suitable. In the case of fermented beans the procedure is more troublesome but still practicable for comparative purposes. Useful additional data for comparing the tannin content of different samples may be provided by the amount of phlobaphene produced by acid hydrolysis. Stained goldbeaters skins graded on a roughly qualitative scale were used for comparison with the results of the two gravimetric methods. The possible utility of the 3 methods as a means of differentiating between the various grades of cacao is discussed.

1034. DUTHIE, D. W. 633.74
Biochemical problems in cacao production.
Sixth annu. Rep. on Cacao Research for 1936, I.C.T.A., Trinidad, 1937, pp. 48-51.

A survey is made of the unsolved problems of cacao production as they affect the commercial product. *Type.* There is a lack of knowledge of the attributes of quality. The white bean of Criollo cacao will command a higher price than the purple Forastero, but the essential differences between the two affecting quality are as yet undiscovered. *Fermentation* causes desirable changes in the composition of the bean yet cannot overcome differences in type. The striking change in colour from purple to brown shows that the purple pigment may be involved in some way in the improvement of quality by fermentation as may the reduction of theobromine in the kernel [see abstract 1032] and the changes in the tannin complexes [see abstract 1033]. The high priced white Criollo requires only 60 hours of fermentation while Forastero or Calabacillo require from 10-11 days in order to change the pigment to brown. Does this lengthier fermentation affect the flavour and aroma? May the fact that no striking differences have been found between the tannin content of light and dark coloured beans be partly accounted for by the difficulties in estimating tannins? *Drying.* The excessive rapidity of artificial drying after fermentation may cause undesirable biochemical changes and sufficient time is not always allowed for the oxidative enzymes to develop their full desirable effects. *Roasting.* The significant changes occurring during this, the most drastic treatment applied to cacao beans, have not yet been conclusively elucidated, chiefly because the analytical methods hitherto

applied to cacao products have not been sufficiently selective. The quality of the roasted bean must be in some way related to the chemical composition of the fresh bean and its internal changes during curing. *Chemical components.* The suggestion is made that, if the natural fat content of the cacao bean could be raised by genetic selection, the value of the new raw material might be greater than at the present time. Lecithin content, too, might be increased by the same means and possibly by manurial treatment.

1035. ANON. 633.74-2.4

A new disease of cacao in the Gold Coast.

Trop. Agriculture, Trin., 1937, 14 : 84, reprinted from Gold Coast Fmr, Vol. 5, Nos. 7 and 8.

The disease which has been provisionally named "swollen shoot" and "die back" has recently been found in the New Juaben district, Gold Coast. The symptoms are an irregular thickening of the chupons in the form of abnormal swellings separated by constrictions. An accompanying and more serious symptom is a general defoliation and dying back affecting all parts of the tree simultaneously. Roots appear normal except for similar occasional swellings. The disease affects groups of trees, apparently extending radially from a central point, reaching in one case a spread of 30 yards in two years. Young seedlings are also affected. Preliminary investigations have isolated a fungus as the probable cause. If confirmed this will place the disease in the withertip class. Control measures will involve the cutting out and burning of all diseased and a few of the surrounding apparently healthy trees (for the latter compensation will be paid), the planting of windbreaks and the growing of food crops on the cleared land for a year before replanting is permitted.

1036. O'BRIEN, T. E. H. 633.912-1.536

1. Stumped buddings. 2. Transplanting dormant stumps.

Quart. Circ. Ceylon Rubb. Res. Scheme, 1937, 14 : 22-4.

1. *Stumped rubber buddings* are seedling stocks budded in the nursery, cut back to allow the scion buds to grow and transplanted to the field when the scions can be cut back to brown wood to a height of 6-8 ft., usually 18-24 months after budding. An experiment indicates that stumped buddings show an advantage of 6 months' growth over dormant budded stumps and 12 months over seed sown at stake for subsequent budding in the field. No losses occurred in transplanting 400 stumped buddings and subsequent growth was vigorous. To prepare stumped buddings seeds must be sown 3 years before the final transplanting. The layout recommended is—rows 18 inches apart with a planting at 18 inch intervals, on the quincunx system, of 3 germinated seeds at the corners of a 4 inch triangle, the 2 weakest being eliminated before budding. The importance of good soil and cultivation is stressed, since success in the field depends largely on the food reserves built up in the nursery. 2. *Transplanting dormant stumps.* The method now followed by the Research Scheme is to ring bark the plant in the nursery 8 in. above the bud patch 7-10 days before transplanting. The bud is thus stimulated before the root system is disturbed. On transplantation the stock is cut off 6 in. above the bud patch. The stump is removed with as little damage as possible to the tap or side roots, and any unavoidable pruning of side roots should not be done within 12 inches of the plant. The cut end of the stock is waxed to prevent loss of moisture.

1037. PARK, M. 633.912-1.537

Line sites and *Hevea* nurseries—a warning.

Quart. Circ. Ceylon Rubb. Res. Scheme, 1937, 14 : 19-21.

Nursery sites for *Hevea* should be on flat land and near a water supply. Lines formerly occupied by labourers often present these conveniences and in addition are usually already denuded of trees. For a number of causes such lines are usually alkaline, whereas to produce normal growth many tropical crops such as *Hevea* and tea require an acid soil (pH 5-6). If such a site

must be used, a dressing of 10 cwt. per acre of flowers of sulphur may make the necessary alteration in about 6 months. Nurseries already planted, which show ill effects from alkalinity, can be treated by flowers of sulphur as before with the addition of sulphate of ammonia applied in solution at the rate of 2 cwt. per acre or 3 oz. to 4 gallons of water applied at the rate of 1 gallon per sq. yd. and repeated in a month's time, if improvement has not occurred. The solution should be applied immediately round the plants rather than generally over the soil.

1038. PHILPOTT, M. W.
Artificial rubber.

678.7

Quart. Circ. Ceylon Rubb. Res. Scheme, 1937, 14 : 1-10.

The various types of so-called synthetic rubber manufactured in U.S.A., Germany and Russia are described (though it must be understood that the rubber hydrocarbon has probably never been synthesized). In U.S.A. an elastic solid of rubbery character obtained by the polymerization of chloroprena is sold under the name Neoprene. The manufacturers consider it will never be so cheap to produce as natural rubber (present cost $3\frac{1}{2}$ times that of smoked sheet). Its advantages over plantation rubber are a greater resistance to oxidation and to the deteriorating actions of oils and heat, and a 20% increase in abrasion resistance. Unfavourable characters are a disagreeable odour unfitting it for domestic use and a toughening with age of the raw product particularly under warm conditions. Neoprene latex is, however, cheaper to manufacture than the solid form and articles made from it are said to require no vulcanization. In Germany artificial rubbers Buna 85 and 115 are made by polymerizing butadiene in the presence of metallic sodium. Buna N and S are made by the polymerization of butadiene in emulsion form together with other substances which modify the properties of the product, in the case of Buna N probably acrylic nitrile. Buna N, the chief of this group, has the good qualities of Neoprene with an even greater abrasion resistance increase over rubber (60%). Cost of production is 3s. 6d. to 4s. per lb. Information from Russia is voluminous, vague and inconsistent. The synthetic rubber-like materials produced are Sovprene, a polychloroprene analogous with Neoprene, and SKA and SKB, butadiene polymers of the Buna type. Most of the output is made by the SKB process by converting (potato?) alcohol by high temperature cracking to butadiene, which is then polymerized with metallic sodium. The yield from 100 lb. alcohol is less than 30 lb. Samples of the product have not been obtainable for examination outside the Soviet Union. The influence of the production of artificial rubber on the plantation rubber industry is discussed.

1039. FENNAH, R. G.
Lepidopterous pests of the sour-sop in Trinidad. (1) *Cerconota (Stenoma) anonella* Sepp.

Trop. Agriculturist, 1937, 14 : 175-8, bibl. 4.

The attacks of this pest on the fruit of the sour-sop (*Annona muricata* L.) are very severe and materially reduce supplies to the local markets. The life history is described. Complete control has been obtained by bagging the fruit with cloth or waxed paper before it has reached 2 inches in length. Another method giving good results is to spray or dip the young fruit in a 2% suspension of lead arsenate with casein, 3 applications in all being required. The fruit is not attacked when under 2 or over 6 inches in length.

1040. FENNAH, R. G.
Lepidopterous pests of the sour-sop in Trinidad. (2) *Thecla ortygna* Cramer.

Trop. Agriculture, Trin., 1937, 14 : 244-5, bibl. 1.

Damage is caused by the larvae of this butterfly hatched from eggs laid chiefly on the flowers of *Annona muricata*, the favourite site being the outer wall of the perianth and its junction with the peduncle. Usually only one egg is laid on a flower. The flowers so attacked fail to develop into fruit. Treatment consists in the removal of the egg which is clearly visible. To be effective

the flowers must be inspected every two days. Spraying with a weak suspension of lead arsenate is also effective.

1041. BIJHOUWER, A. P. C. 634.441 : 581.46/7
*Een bijdrage tot de kennis omtrent het bloeien en het vruchtdragende vermogen van der mangga (*Mangifera indica* L.) (Flowering and fruiting habits of the mango.)* [English summary 6 pp.]
 H. Veenman & Zonen, Wageningen, 1937, pp. 106, bibl. 103.

The studies were undertaken in Java from 1931 to 1936 as a basis for further cytological and physiological experiments, on 13 trees comprising 7 Java and 1 Alphonso varieties of mango. *Flowers and flowerheads* are described. The length of the inflorescences was 23-60 cm., the breadth 10-40 cm. Flowering progressed from base to top of the panicle and from centre to circumference. The flowers in each panicle were staminate or bisexual, and opened at night or in the early morning, the anthers bursting an hour later. The flowering periods of the panicles were from 11 to 29 days. The total number of its flowers may be from 788 to 9,020. Percentage of bisexual flowers in the Alphonso was from 6 to 11%. All the Java varieties had higher percentages, up to 55%. Dropping of unset flowers took 6-32 days, and was followed by a fruit drop lasting a month, by the end of which period the trees had contrived to rid themselves of 99% of the original complete flowers or young fruit. Those remaining attained full size in 7 weeks and were fit for picking in a further 5 or 6 weeks. *Yield of flower heads.* Tables are given showing average number of panicles, yield per panicle and number of fruits per 100 fruiting panicles for the varieties studied. *Caging experiments.* Cellophane proved the best caging material for pollination experiments; humidity within the cage containing a panicle differing only slightly and for very short periods from the humidity without. The material was the water-permeable ordinary viscose cellophane. The cages were removed immediately after flowering was over and no abnormal fruits were obtained. Temperatures within the cages were from 4 to 7° C. higher than outside. Some varieties were able to set fruit within the cages without the aid of wind or insects. There was a great number of swelling ovules directly after flowering even in the unpollinated caged panicles. The error of computing fruit set from the number of swelling ovaries is pointed out. *Mango flowers and bees.* One hive containing about 15,000 bees was allocated to every 10 trees. Certain varieties proved more attractive to bees than others, and those of commercial importance could be placed in the "bees frequent" and the "bees not infrequent" classes. The bees were able to support themselves and even to make surplus honey on the mango inflorescences, but had to be fed as soon as the flowering season was over. An annual additional 23 fruits per tree as a result of beekeeping would repay the cost to the European planter, while native growers who make the appliances themselves would be even better off, since both the beeswax and the larvae have uses in their domestic economy.

1042. WAGER, V. A. 634.441-2.3/4
Mango diseases in South Africa.
Fmg S. Afr., 1937, 12 : 321-4, bibl. 7.

Bacterial black spot (*Bacillus mangiferae*) is a destructive disease occurring only in S. Africa. The symptoms are the appearance of black angular spots on the leaves and black gumming lesions and cracks on the stems and fruit. A fairly effective control can be obtained by a bordeaux spray applied fortnightly in dry weather as soon as lesions on the fruit are noticed, usually in November, and immediately after every rain storm until mid-January. Anthracnose (*Colletotrichum gloeosporioides*) is manifested as a rapidly spreading black area appearing on the fruits, often between picking and consumption. Flower clusters may also be destroyed. A comprehensive bordeaux spraying of 8 applications starting at the flowering period is suggested following the practice in Florida. Sooty blotch (*Gloeodes pomigena*) is superficial but spoils the appearance of the fruit. A bleaching solution of $\frac{1}{2}$ lb. each of chloride of lime and boracic acid to 1 gallon of water is recommended for use as a dip. Mildew (*Erysiphe cichoracearum*) causes the flowers to wither and seriously reduces yield. Dusting 2 or 3 times with sulphur or spraying with bordeaux during the flowering period is recommended.

1043. SUBBIAH, M. 634.58-1.8
A short note on groundnut. Manurial experiments of the Irwin Canal Farm, Mandyā.

J. Mysore agric. exp. Un., 1936/7, 16 : 187-93, bibl. 2.

On a sandy and gravelly soil at Mandyā, Mysore, groundnuts failed to respond to nitrogen applied as ammonium sulphate. The addition of potash (90 lb. muriate of potash per acre) to phosphoric acid (80 lb. per acre) increased yield significantly. A double dose of potash failed to increase the yield more than a single dose. The results of experiments carried out on various soil types in other parts of India and in Burma are briefly summarized. In the Central Provinces the cotton yield was increased by 130% after the inclusion of groundnuts in the rotation.

1044. BELGRAVE, W. N. C., AND LAMBOURNE, J. 634.6-1.8
Manurial experiments on oil palms.

Malay. agric. J., 1937, 25 : 286-96, bibl. 4.

A report is made on certain manurial experiments on oil palms initiated in 1929. On Estate A all treatments of mature palms were significantly better than the controls and phosphatic manures alone were just as efficient as complete manures. Cessation of manuring reduced yields. It is considered that intervals between applications should not exceed 18 months. An addition of 4 lb. per palm of rock phosphate to all treatments in 1935 gave little result except on the controls, which showed increased yields. On Estate C with immature palms planted in 1929 manuring began in 1932, continued half-yearly to February 1934, ceased until July 1935 and was then resumed with heavier dressings; there has been no application since. No significant results appeared until 1936 when NPK and NP yielded better than the controls with NP superior to N or P alone. There was no significant difference between yields from NP and NPK or between N or P and the controls. [In an appendix are noted the results of somewhat similar experiments made by the Imperial Chemical Industries at Selangor and Perak.—ED.]

1045. WARDLAW, C. W. 634.771-2.3/4
Banana diseases. XI. Notes on some plantation diseases in Guadaloupe.

Trop. Agriculture, Trin., 1937, 14 : 279-80, bibl. 9.

Notes are given on the diseases of banana in Guadaloupe (French Antilles). There the banana of commerce is Congo, a mutant of intermediate stature belonging to the Cavendish group. The following diseases are treated in brief. Panama disease (*Fusarium oxysporum cubense*) ; Bacterial wilt disease (*Bacterium solanacearum* E. F. Sm.) ; virus and heart rot, *Cercospora* leaf spot (*Cercospora Musae* Zimm.) ; *Cordana* leaf spot (*Cordana Musae* (Zimm.) Höhn.) ; leaf speckle (*Chloridium Musae* Stahel) ; black tip (*Helminthosporium torulosum* (Syd.) Ashby) ; injury by thrips (*Frankliniella insularis*) and by borer (*Cosmopolites sordidus*).

1046. STAHEL, G. 634.771-2.48
Banana leaf spot (*Cercospora Musae*).

Trop. Agriculture, Trin., 1937, 14 : 59-60.

Banana leaf spot is causing increasing loss in the West Indies and elsewhere. The symptoms and mode of infection and growth are described. Good control has been obtained in Surinam by spraying 2 or 3 times a year with bordeaux mixture. In heavily infected fields the protection of the lower side (through which the fungus obtains entry) of the 2 or 3 youngest leaves grown after spraying may be increased by stripping the older badly spotted lower leaves which are the source of infection. It may be necessary in the case of severe attack to repeat the spraying in 15-20 days.

1047. STAHEL, G. 634.771-2.48
Notes on *Cercospora* leaf spot of bananas (*Cercospora Musae*).

Trop. Agriculture, Trin., 1937, 14 : 257-64, bibl. 11.

This paper contains an extensive mycological study of the banana leaf spot disease, *Cercospora Musae*. The disease attacks only the youngest leaves, mainly the lower surface of the 2 most

recently unfolded, and takes 5 weeks to become visible. Preventive measures consist of spraying the 3 youngest leaves with the Bayer fungicide and an adhesive. The fungicide is immediately dissolved in water and requires no other preparation. Bordeaux mixture can also be used, but neither of these preparations will reduce the infective material on the lower leaves. The latter, however, if heavily spotted may with advantage be stripped and burnt. In cases where seasonal outbreaks occur, the stripping must be done 5 weeks in advance of the anticipated date of attack.

1048. WARDLAW, C. W. 634.771-2.48
Banana diseases. X. Further observations on *Cercospora* leaf spot of bananas.

Trop. Agriculture, Trin., 1937, 14 : 117-8.

An account is given of the occurrence and spread in Trinidad of *Cercospora* leaf spot. Physiological observations which call for comment are:—Infection of the youngest leaves only is possible, but through prolonged incubation the disease only becomes apparent in the older leaves. In many instances there appears to be a definite connexion between intensity of spotting and certain adverse growth conditions such as unfavourable water relationships. The cumulative effect of severe leaf spotting appears to create a physiologically unbalanced condition, which is strikingly exhibited in the fruit by the marked pinkish colour of the pulp of prematurely ripened fingers and less conspicuously in a characteristic pale bluish discolouration of some of the vascular strands of the true stem. These stages can also be observed while the bunch is quite immature by sectioning the pseudo-stem.

STORAGE.

1049. EAVES, C. A. 664.85.11
Storage problems.

Seventy-third annu. Rep. Nova Scotia Fruitgrs Ass. for 1936, 1937, pp. 72-9.

An account is given of the storage work (1935-6) at the Kentville experiment station, Nova Scotia, both as regards fundamental investigations and that directed towards the solution of practical problems. *Fertilizer effect.* Fruit from Gravenstein and Wagener trees on complete fertilizer plots were less affected by internal breakdown than the control plots or those receiving one or two elements only. Continued use of lime on McIntosh plots induces "corky condition" predisposing the fruit to early breakdown in storage. The incidence of scald, greatest on the complete fertilizer plot, is correlated directly with the amount of green ground colour and appears to be limited, not by maturity as might at first appear, but by the amount of red pigment in the skin. *Temperature and maturity effects.* The specific reaction was recorded of a number of varieties each packed at 3 different stages of maturity and held at temperatures of 32°, 35° and 38° F. The results are given for each variety but cannot usefully be compressed into a brief abstract. A first year's work on gas storage showed, among other results, that a concentration of 5% CO₂ at 38° and 40° F. was a most successful treatment for McIntosh apples. *Pre-storage anaesthesia.* Apples treated with 100% N₂ at 40° F. for 1 week before storing remained in good flavour and condition for 7 months. Treatment with 100% CO₂ under similar conditions of time and temperature proved too long. *Russet apples and storage humidity.* Shrinkage is the major problem with Russets. The water loss was greater at 32° than at 38° F. Relative humidities in earth-floored cellars were 85-90%, in cement-floored only 70%, with a corresponding increase in loss of moisture from the fruit. Evaporation seems to be reduced by lining the barrels with oil paper. *Handling and warehouse-management.* The results obtained from an experimental shipment of apples and pears in a fully refrigerated steamer are summarized under 9 heads. *Warehouse ventilation.* Considerable attention has been paid to warehouse ventilation, the importance of which is emphasized, and instructions regarding proper warehouse management have been prepared for distribution.

1050. COMIN, D.

664.85

The common storage. Its construction and management.*Bull. Ohio agric. Exp. Sta. 573, 1936, pp. 49, bibl. 23.*

For those wishing to build ventilated stores for fruit under similar climatic conditions this bulletin should prove extremely useful. Observations for 40-50 years in Ohio show a 10 degree reduction in outside temperature per month from 63-69° F. (north to south) in September to 52-57° F. in October, 40-50° in November to 28-35° F. in December. The daily range varies from 15° to 20° F. and the daily variability from 3° to 5° F. The factors affecting fruit storage and the principles of ordinary storage are first enunciated. Next all the necessary details are given for the erection and equipment of an ordinary ventilated store, considerable attention being given to insulating materials and the construction of floor, wall, ceiling, etc. Notes are given on ventilation, on the remodelling of old farm structures for use as stores, and on general management in autumn and winter.

1051. D.S.I.R. LONDON.

664.8

Engineering.*Rep. Food Invest. Bd, Lond., for 1936, 1937, Section VIII, pp. 211-32.*

Short reports of work on the engineering side of storage mainly with reference to fruit deal with the following :—The thermal conductivity of the tissue of fruits, pp. 211-12 ; the transfer of heat from apples to a stream of air, pp. 212-14 ; the package in relation to the transfer of heat pp. 214-16 : the "jacket" system in the experimental hold, pp. 216-27 ; physical properties of refrigerating brines, pp. 227-30 ; low temperature thermal conductivity apparatus, p. 230 ; evaporation from wet surfaces, pp. 230-31 ; and apparatus for control of humidity.

1052. VAN DER PLANK, J. E., AND DAVIES, R.

664.85.037 : 632.19

Temperature—cold injury curves of fruit.*J. Pomol., 1937, 15 : 226-47, bibl. 18.*

The paper which is illustrated by graphs is in three parts dealing respectively with I. General thermochemical considerations, II. Primary susceptibility which is inherent in the fruit at the time of storage, and III. Secondary susceptibility, which results from changes in the fruit after cooling. The authors summarize as follows :—

Part I. After relatively short periods in cold store, breakdown of plums, woolliness of peaches and pitting of Marsh grapefruit usually occur to a maximum extent at intermediate temperatures. At higher or lower temperatures there is less injury. That is, the injury temperature curves usually show a peak. This peak seems to be a necessary consequence of the interaction of two opposing factors in the development of cold injury :—(1) *An equilibrium factor*. Lowering the temperature increases the disposition towards injury. (2) *A kinetic factor*. The higher the temperature the sooner does the injury become manifest, indicating a process governed by the thermochemical rule that the rate of change is reduced as temperature is lowered. The temperature of maximum injury is labile and is not a fixed characteristic of the fruit. It may occur above or below the freezing point of the fruit. The latter cannot be demonstrated but must be assumed. The gradation from a peaked curve to an incomplete curve without demonstrable peak has been shown for Marsh grapefruit. The three factors which lower the temperature of maximum injury are :—(a) greater resistance of the fruit ; (b) longer period of storage ; (c) a faster rate of manifestation of injury.

Part II. The number of fruits injured does not increase indefinitely as the period of storage is lengthened. A "maximum" is reached which is sufficiently definite to be considered as a first approximation. The number of fruits injured when the maximum is reached is greatest at the lowest temperature, but the maximum is reached soonest at the highest temperature. Q_{10} values are given for the rate of development of injury. The fact that a maximum is reached at each storage temperature indicates that the susceptibility to injury exists in the fruit at the time of cooling. This is referred to as "primary susceptibility". Frequency distribution curves of the "primary susceptibility" of a population of fruit over a range of storage temperatures can be prepared. It is shown that the efficacy of any measure which reduces primary

susceptibility may be measured in terms of shifting the frequency distribution curves of susceptibility down the temperature axis.

Part III. The maximum injury referred to in Part II. is not always a true maximum. Fruit changes during storage, and these changes result in further development of susceptibility to injury. This is referred to as "secondary susceptibility". Injury due to primary and secondary susceptibility can be allocated. Various fruits may show only primary or secondary or both together. The factors which predispose fruit to secondary susceptibility do not appear to be directly related to those causing primary susceptibility. The simple scheme of analysis proposed is applied to the data of Kidd and West on cold injury of apples to illustrate the amount of information which may be gained.

1053. FURLONG, C. R., AND BARKER, J. 664.85.037

The conditioning of cold stored fruit prior to retailing.

Rep. Food Invest. Bd, Lond., for 1936, 1937, p. 160.

Conditioning Williams' and Clapp's Favourite pears and Santa Rosa and Gaviota plums at 65° F., after removal from store prior to putting on the market, has been found to improve quality and diminish wastage. The fruit should be conditioned to at least an eating-ripe stage.

1054. SMITH, W. H. 664.85.75.037

The cooling and storage of strawberries.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 155-9.

A series of experiments was carried out in 1936 to determine the effect on the fruit of different temperatures after picking and of the degree of ripeness at picking. Two types of wastage were recognized, namely spoilage by moulds and the development of soft mushy pink areas, which subsequently rotted. Unfortunately owing to rain at picking the rates of wastage were all very high and no conclusion could be reached as to the relative efficiency of cooling with air at 45°, 38°, 32° and 28° F. in delaying subsequent wastage. Cooling at 28° F. appeared to have no ill effects on subsequent behaviour. It was found that all the cooled fruit showed more rapid wastage on exposure to 65° F. than freshly picked samples exposed at once to 65° F. On the other hand wastage of both types was retarded by low temperature storage, and the effect of storing for 4 days on wastage per cent. on removal to a temperature of 65° F. is here tabulated. The course of respiratory activity of strawberries at 32°, 45°, 59° and 65° F. in conjunction with maturity at picking was also noted and graphed, three fruits being observed in each case. At the three higher temperatures respiratory activity increased rapidly with time, but at 32° F. little change was evident in the level of respiratory activity. The levels of respiratory activity for green, red-green, trace of green and red berries were in increasing order of size, as were also the initial values. Graphs and tables show the results clearly.

1055. KIDD, F., AND WEST, C. 664.85.13.035.1+664.85.13.037.

The cold storage and gas storage of English grown Williams' Bon Chrétien pears.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 113-26, bibl. 6.

The authors report on cold storage and gas storage trials with Williams' pears carried out in the seasons 1935-36 and 1936-37. In 1935-36 the pears had an average weight of 135 g. and a hardness value of 22.5 and were laden with starch and in 1936-37 of 133 g. and 23.5 lb. respectively and contained somewhat less starch. [The dimensions of the plunger used for hardness tests were:—diameter of head (slightly convex) 8 mm., depth of penetration 8.2 mm.] They were stored in air at temperatures ranging from 24° C. to -0.25° C. and in gas mixtures at 1° C. only. The gas mixtures used were 2.5% O₂+5% CO₂, 2.5% O₂+10% CO₂, 5% O₂+5% CO₂ and 10% O₂+10% CO₂. Observations on respiratory activity and on softening are graphed. The application of results to commercial storage are discussed. It is concluded that Williams' pears can be safely gas stored at 1° C. in any of the 4 mixtures used. The 5% CO₂+5% O₂ mixture yielded fruit of good quality for storage periods of 5 to 6 months and the others for periods of over 7 months, whereas the fruit stored in air was useless after 2 months' storage at 1° C. The available evidence

indicates that the successful achievement of long periods of storage depends largely on bringing the fruit into gas store at a low temperature with the minimum of delay after gathering. No brown heart was seen in these gas storage experiments. Finally it may be noted that the pears are readily handled without much risk of consequent browning of the skin when removed from gas store in a hard green state.

1056. HANSEN, E., AND HARTMAN, H. 664.85.13.037 : 581.192 : 547.313.2
Effect of ethylene and certain metabolic gases upon respiration and ripening of pears before and after cold storage.
Plant Physiol., 1937, 12 : 441-54, bibl. 16.

The results obtained with both pre- and post-storage pears indicate that the effects of ethylene are confined to the period preceding that stage in the life of the fruit when the maximum level in respiration has been reached.

1057. SMITH, W. H. 664.85.22.037
The low-temperature storage of plums.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 153-5, bibl. 1.

Previous observations that Victoria plums have a storage life of 3-4 weeks have been confirmed in the main. It was found that Victorias picked immature and partially green are unlikely to attain a good quality if stored at a low temperature ($31\cdot5^{\circ}$ F. or 34° F.) for more than a week. Plums held at $31\cdot5^{\circ}$ F. and 34° F. generally showed less fungal wastage after removal from store than those stored at 37° F. and 40° F. There was some indication that internal browning—which was not, however, serious—was more prevalent in fruit stored at $31\cdot5^{\circ}$ F. than at higher temperatures.

1058. BARKER, J. 664.85.872
The storage of hot-house grapes.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 152-3.

The method used commercially in Belgium for the cold storage of hothouse grapes has given promising results in this country with muscats. In picking about 8 inches of the parent stem is removed with each bunch. The end of the stem is then immersed in water in a bottle supported on a wooden stand, so that the bunch hangs freely from the stem. The stands are kept in a cold chamber ($30\text{--}34^{\circ}$ F.) furnished with forced air circulation. Grapes cut on 27 November, when just ripe for marketing but still green were stored thus at 30° F. Seven weeks later practically no shrivelling or discolouration had occurred and the condition was maintained 14 days after removal to room temperature. After 10 weeks at 34° F. the berries were slightly shrivelled but otherwise colour and appearance were good. After 14 days at room temperature shrivelling and discolouration were in this case, however, severe. The humidity was 80-85 per cent. relative humidity. Grapes cut slightly more mature did not keep so well.

1059. DUSTMAN, R. B. 664.85.51
The storage of black-walnut kernels.

Food Res., 1936, 1 : 247-53, bibl. 2.

Search for a simple method of retarding or preventing rancidity in stored black-walnut kernels included storage trials at several temperatures in air, nitrogen, hydrogen, carbon dioxide, vapours of ethyl alcohol with air or nitrogen and partial desiccation prior to storage in air. The temperatures utilized were those in (1) ordinary unheated cellar storage with a range of $-8\cdot3^{\circ}$ to $26\cdot7^{\circ}$ C. (17° to 80° F.), (2) fruit storage with a range of $0\cdot6^{\circ}$ to $2\cdot2^{\circ}$ C. (33° to 36° F.), and (3) storage below freezing with a range of $-17\cdot8^{\circ}$ to $-12\cdot2^{\circ}$ C. (0° to 10° F.). The treatment involving storage in an atmosphere of nitrogen at temperatures near the freezing point gave the most satisfactory results from the dual standpoint of convenience and quality of product. Kernels stored under these conditions may retain a satisfactory flavour and palatability over

a period of 2 years or longer. Lower temperatures were effective but unnecessary. Storage in air-tight containers was superior to storage in screw-cap glass jars which were not air-tight, especially at ordinary cellar temperatures. [Author's summary.]

1060. FURLONG, C. R., AND BARKER, J. 634.1/7-1.564+664.85

The effect of the container on the wastage in packaged fruit.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 160-4, bibl. 5.

Increased ventilation and core breakdown in pears. Further experiments confirm the fact that core breakdown occurs less rapidly in a fast than in a slow air stream. Experiments would appear to be necessary with boxes and types of packing in which provision is made for more ventilation than in the present types. *Effect of box on commercial life of pears.* Beurré Bosc not unpacked till fully ripe had only about two-thirds the marketable life of those unpacked on arrival and ripened on trays. The quality of pears ripened in the box was inferior to that of tray-ripened fruit. *Bitter pit in apples.* Bitter pit incidence was greatest in amount in the fruit in contact with the wood of the box. *Rotting in apples.* Observations on New Zealand Cox's Orange Pippins showed that rotting was greater in amount in the fruit in the inner layers. *Position in box of oranges.* After storage for 30 days at 60° F. the loss of weight was twice as great in the outer as in the inner layers.

1061. TOMKINS, R. G. 664.85.038

Treated wraps for the prevention of rotting.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 149-51, bibl. 2.

In a brief note the author states that the rotting of certain fruits can be delayed and reduced by wrapping in paper impregnated with iodine or diphenyl. A derivative of the latter, namely o-phenyl-phenol, also checks growth at a distance, i.e. it is both volatile and fungicidal and, if fruit is wrapped in paper impregnated with a solution of this substance in mineral oil, rotting can be reduced. If, however, fruit is wrapped in paper directly impregnated with the substance, severe scalding occurs. The amount which can profitably and without risk of damage to fruit be introduced into wraps appears to vary with the variety of fruit.

1062. FURLONG, C. R., AND SCHIMMER, F. C. 664.85.11.021

The effect of the wrapper on wastage.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 164-5.

Observations on 12 boxes of Cox's Orange Pippin apples from New Zealand showed that bitter pit was greater in amount in fruit wrapped in oiled wrappers than in that in plain wrappers. Differences were very striking. In another 5-box trial of plain and oiled wraps Brazilian Pera oranges wilted rather less when oiled wraps instead of plain wraps were used.

1063. MANVILLE, J. A., AND OTHERS. 634.11 : 577.16

Vitamin studies on apples.

Food Res., 1936, 1 : 121-40, bibl. 8.

In an earlier series of experiments* the contents of vitamins A, B and C in several apple varieties were determined by feeding carefully peeled fruits to guinea-pigs. In the present series apples of 7 varieties were mostly fed unpeeled. Vitamin A was determined by a new method based on determining by autopsy which group of animals received the least amount of supplement without showing definite symptoms of vitamin A deficiency. The following vitamin A values were obtained with the varieties tested:—Arkansas Black 36 units per ounce, Baldwin 15, Delicious 24, Gravenstein 14 to 17, Jonathan 24, Spitzbergen 36 and Winesap 36 units. Tests for the vitamin B complex on Delicious, Gravenstein and Spitzbergen indicated that the apple is not a good source of these vitamins. The vitamin C values found were:—Arkansas Black less than 2.5 units per ounce, Baldwin 2.5 to 3.0, Delicious less than 2.5, Gravenstein 3.75,

* Idem, "Vitamin studies on apples." 1 The Vitamins A, B and C content of the Rome Beauty, Delicious, Stayman, Yellow Newton and Winesap. *J. Amer. diet. Ass., 1934, Vol. 10, p. 125.*

Jonathan 1·5 to 2·0, Spitzbergen 7·0 and Winesap 3·0 units. The loss of vitamin C in apples stored for a long period proved to be relatively greater than the loss of vitamin A, although it varied with the variety, Jonathan losing relatively more vitamin C than did Delicious. Comparisons between carefully peeled and unpeeled apples showed that the former did not contain markedly lower vitamin C contents than did the latter. Finally, data are presented which substantiate the statement made in the earlier paper, that the vitamin A and vitamin C values are associated with gene activity rather than chromosome number.

1064. ZILVA, S. S., AND OTHERS.¹

577.16 : 634.11

The metabolism of ascorbic acid in the apple fruit.

Rep. Food Invest. Bd, Lond., for 1936, 1937, p. 136.

The indications given in the previous year's work that the oxidized form of the vitamin is present as such in apple tissues and is not formed in the process of manipulation by enzymic oxidation are supported by further evidence.

1065. SMITH, W. H.

634.11 : 581.145.2 : 576.3

Anatomy of the apple fruit.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 137-9, bibl. 3.

Observations on the size of cells determined about 0·5 cm. beneath the skin at the equator of the fruit suggests that a relation exists between cell size and magnitude of respiratory activity in the 8 English varieties tested. Worcester Pearmain and Grenadier with the highest respiratory activity were those with the smallest cells, while Bramley's Seedling and Newton Wonder showed the largest cells and the lowest respiratory activity, and Cox's Orange, Blenheim Orange, Allington and Lane's Prince Albert were intermediate in both respects. Five out of a further eight varieties not originating in England showed the same phenomenon, while the remainder, Baldwin, Rome Beauty and Ontario, did not fall into line in this particular. Cell size of Grenadier grown on Northern Spy and of Grenadier on Malling No. XVI stock was not appreciably different.

1066. HORNE, A. S.

634.11-2.4

The resistance of the apple to fungal invasion.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 141-6, bibl. 8.

Observations made in 1931 and 1932 are tabulated here and indicate that relationship between estimates of mortality and of quality, as measured by radial advance, has been found solely in instances where natural infection is known to have been heavy and where sour varieties have been tested, the sourness limiting to a few the number of attacking organisms. As regards rootstock a statistical analysis of data obtained over a period of 5 years shows that in the case at least of Bramley's Seedling, Lane's Prince Albert and Worcester Pearmain with regard to *Cytosporina ludibunda* and *Fusarium fructigenum*, rootstock has a definite effect on resistance to invasion. Manuring is also found to be an important factor and inoculation experiments with apples from Cheshire and Northern Ireland show that resistance in fruit from trees treated with potash or superphosphate or both was greater than that in fruit from trees treated with nitrogen.

1067. HULME, A. C.

581.111 : 634.11 + 664.85.11

The metabolism of nitrogen in apple fruits.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 126-31, bibl. 6.

Examination of fruits taken from the tree at different stages of fruit development leads the author to make the following deductions:—The critical period in the fruit's metabolism of nitrogen occurs immediately before the climacteric rise in respiratory activity. A profound change in the fruit's nitrogen metabolism takes place in the region of the climacteric. In examinations made no significant change could be found in the total nitrogen of the fruit during the period, so that the gain in "protein" nitrogen was in the first instance at the expense of asparagine. At the peak of the climacteric both the asparagine and the amino-acid fractions contributed to the rise in protein. Further, Bramley's Seedling trees 21 years old were injected with the following compounds, each tree receiving one solution only:—urea, urea + fructose,

urea + glucose, urea + sodium phosphate, and sodium phosphate. Analysis of fruit from the injected and control trees showed that the injection had a definite effect on rate of respiration. Apples from trees injected with urea had an appreciably higher rate. "Phosphate injected" fruit had a rate similar to that of control trees; fruit from urea injected trees had a relatively high rate, whereas the combination of urea and phosphate produced fruit of a very low rate of respiration and an appreciably delayed climacteric.

1068. KIDD, F., AND HANES, C. S. 664.85.11 : 581.192
Hydrogen-ion concentration in apples.

Rep. Food Invest. Bd., Lond., for 1936, 1937, pp. 133-5, bibl. 2.

The hydrogen-ion concentration of the sap of small Bramley's Seedling apples (av. wt. 30 g.) was examined during prolonged storage at different temperatures. The initial pH was about 2.82 and this increased during storage at all temperatures. It is concluded from observations made by the authors and by Haynes and Brown that the drifts of pH at all the temperatures are explicable on the basis of decreasing concentration of free malic acid in the presence of a small amount of a monobasic salt which remains constant in concentration. The effect was also tried of storing at 10° C. in nitrogen and in an atmosphere containing 10% CO₂, 20% O₂ and 70% N. The drifts in pH values were not distinguishable from those found in apples stored in air at the same temperature.

1069. FIDLER, J. C. 634.11 : 581.12
Aerobic and anaerobic catabolism of carbohydrate and acid by apple fruits.

Rep. Food Invest. Bd., Lond., for 1936, 1937, pp. 135-6, bibl. 2.

Brief conclusions are drawn from the work on the following points:—(1) Correlation between loss of substrate and accumulation of end product and (2) the rôle of acetaldehyde in the catabolism of carbohydrate.

1070. HANES, C. S., AND KIDD, F. 634.11 : 581.12
The hydrolysis of sucrose by malic acid-malate mixtures.

Rep. Food Invest. Bd., Lond., for 1936, 1937, pp. 131-3.

Observations have so far been restricted to hydrolysis in the presence of malic acid-potassium malate buffer mixtures. The progress of hydrolysis was followed by determination of the reducing power in reaction mixtures containing 0.2 N malate buffers. It was found that rates of hydrolysis in the living fruit greatly exceed the values predicted from observed rates *in vitro* for similar conditions of hydrogen-ion concentration and temperature. It was concluded that a small part of the degradation of sucrose might be explained as resulting from purely acid hydrolysis.

1071. WRIGHT, R. C., AND OTHERS. 664.85.76
Some effects of different storage temperatures on the keeping of cranberries.

Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 397-401, bibl. 1.

36° F. proved to be the most suitable temperature for preserving cranberries in a marketable condition for a storage period of 4 months.

1072. ESSELEN, W. B., AND FELLERS, C. R. 664.85.76 : 634.76
Gas content of cranberries and possible relationship of respiratory activity to keeping quality.

Plant Physiol., 1937, 12 : 527-36, bibl. 9.

Cranberries left on the bushes after raking and subsequently submerged had a much higher rate of respiration a month after picking than cranberries which had been stored during this time and than those which had remained above the water. The rate of respiration is reduced by freezing. Storage temperature has a marked effect upon keeping quality of cranberries. The carbon dioxide content and the carbon dioxide/oxygen ratio vary directly with the keeping quality of the fruit. The nitrogen content of the internal atmosphere of cranberries is relatively

constant and approximates to that of the atmosphere. The carbon dioxide and oxygen contents of the internal gas vary with the rate of respiration. Breakdown in stored cranberries does not occur until the definite amount of respirable material they contain has been used up. It is possible by means of the carbon dioxide/oxygen ratio to forecast with some accuracy several months in advance the keeping quality of cranberries in cold storage. No correlation was found between catalase activity and respiratory activity of cranberries in storage. The potassium permanganate titration method for the determination of catalase activity in cranberries gave rise to inaccuracies due to the interfering substances present in the cranberry.

1073. ROSE, D. H., AND OTHERS. 658.8 : 634.2-2.1/4
Market diseases of fruits and vegetables :—peaches, plums, cherries and other stone fruits.

Misc. Publ. U.S. Dep. Agric. 228, 1937, pp. 26, bibl. 67.

Brief but useful notes are given on the occurrence, symptoms and effects, on the causal factors and on possible control of the following diseases, physiological disorders or infestations as seen in fruits on the market :—*Alternaria* rot, bacterial spot (*Bacterium Pruni*), black mould rot (*Aspergillus* sp.), blue mould rot (*Penicillium* sp.), brown rot (*Sclerotinia fructicola*), California blight (*Coryneum Beijerinckii*), *Cladosporium* rot, cold storage injury, cracking, drought injury, fruit fly injury (*Rhagoletis cingulata*), grey mould rot (*Botrytis* sp.), hail injury, internal browning (seldom found on market), leaf curl (*Exoascus deformans*), oriental fruit moth injury (*Grapholita molesta*), peach twig borer injury (*Anarsia lineatella*), plum curculio injury (*Conotrachelus Nenuphar*), powdery mildew (*Sphaerotheca pannosa*), rhizopus rot (*R. nigricans*), russetting, rust (*Tranzschelia pruni-spinosae*), scab (*Cladosporium carpophilum*), split pits, spray injury and sucking bug. The illustrations are numerous and excellent and include 6 coloured plates.

1074. HAYHURST, H. 664.8 : 632.7
Insect infestation of stored products.

Ann. appl. Biol., 1937, 24 : 797-807, bibl. 9.

The author has made a careful survey of the insects found on the London, Midland & Scottish Railway during the past 10 years in commodities stored in warehouses, goods in transit, and goods offered for warehousing. Photographs are given of the more common types of insect found. The classification is that suggested by Imms, but the orders are arranged according to the importance of their occurrence and the commodities on which they are found are also stated.

1075. POTTER, C. 664.8 : 632.944
A biological study of the fumigation of empty warehouses with hydrogen cyanide and ethylene oxide.

Ann. appl. Biol., 1937, 24 : 415-41, bibl. 36.

The series of experiments indicates the extreme difficulty, if not impossibility, of successfully fumigating empty warehouses against the hibernating larvae of *Plodia interpunctella* with ethylene oxide. Results with HCN were better, but it is still doubtful whether a complete kill can be obtained. Since this series a system has been started whereby the ceilings and other places difficult to fumigate are isolated by means of a sticky band and this offers more hope of success. Further the same author has shown elsewhere that warehouses infected with *Ephesia elutella* and *P. interpunctella* can be effectively cleared of these pests by spraying with a preparation of pyrethrins I and II in a highly refined white oil (*Ibidem*, 1935, 22 : 769-809).

1076. TOMKINS, R. G. 547.476/7 : 632.4
The action of organic acids on the growth of moulds.

Rep. Food Invest. Bd., Lond., for 1936, 1937, pp. 147-9, bibl. 1.

The action of citric acid was studied by putting 5 c.c. of a 4% solution of malt in each of a number of petri dishes and then adding 1, 2, 3, etc., c.c. of a citric acid solution or $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, etc., neutralized citric acid. Sterile water made up the volume to 10 c.c. A small piece of filter paper was put in the centre of each dish and the rate of spread of the mycelium was observed. The growth

varied greatly according to the pH of the nutrient solution ; thus at pH 2 some 1-2% of titratable acid is necessary to stop growth, while at pH 3 8%, at pH 3·7 6% and at pH 4·6 4% is necessary. The action of other organic acids is, when added to an unbuffered nutrient medium, to increase the acidity and reduce growth. If, however, they are added to buffered solutions or are partially neutralized, larger quantities are needed to inhibit growth. They vary in strength and so in the amounts necessary to raise the pH of the solution to a point at which growth stops, but except for citric none of the organic acids studied appeared to possess any toxic properties.

1077. WELTSCH, Z. 664.85.3 : 656
The protection of citrus fruits against mechanical injuries during transport from the packing shed to the ship.
Hadar, 1937, 10 : 172-3.

The author finds that in its progress from packing shed to ship a case of citrus fruit in Palestine suffers 8 unnecessary concussions, each of which is capable of causing damage to the fruit within. Measures are proposed for eliminating some of these jars, including mechanical loading and unloading, stacking and unstacking.

1078. REICHERT, I., AND LITTAUER, F. 664.85.31
A new method of control of wastage in oranges.
Hadar, 1937, 10 : 141-5, bibl. 15.

A new method has been evolved which markedly controls wastage in citrus caused by *Diplodia* stem-end rot and *Penicillium* mould. The method is to place on the stem end by means of a pipette a drop of a disinfectant composed of 13 g. iodine, 10 g. potassium iodide, water 200 c.c., alcohol 800 c.c. Other disinfectants (of which the composition is given) were also tried with somewhat contradictory results. The method is quick and inexpensive and suitable for large scale shipping consignments. At present, however, there is an embargo on the entry into the U.K. of fruit treated by such substances.

1079. RICHARDSON, J. E., AND OTHERS. 577.16 : 634.3
Some observations on vitamin-C content of oranges and lemons.
Food Res., 1937, 2 : 81-3, bibl. 6.

The method used was titration of juice with 2,6-dichlorophenolindophenol and with standard 0·01 N iodine solution. The tests were made just at the end of the California Valencia season and the beginning of the California Navel crop. The Navel oranges had a higher vitamin C potency than the Valencias. On an average it was found that one orange contained 20-30 mg. and one lemon (Sunkist variety) about 18 mg. vitamin C. There was great variation in the lemons.

1080. TOMKINS, R. G. 664.85.31 : 632.4
Ventilation and wastage from green mould in the storage of oranges.
Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 151-2, bibl. 2.

Results of two experiments on the effect of ventilation on the incidence of green mould in stored oranges are tabulated. In one instance lack of ventilation resulted in increased wastage, but in the other it did not increase wastage from green mould, although a slight increase in stem end rotting was noted. The oranges were Navels from S. Africa.

1081. WARDLAW, C. W. 664.84/5 + 656.2
Tropical fruits and vegetables. An account of their storage and transport.
Trop. Agriculture, Trin., 1937, 14 : 70-83, 110-16, 131-9, 163-70, 200-10, 227-34, 265-74, 288-98, bibl. numerous.

In this paper the author summarizes with numerous supporting references to the literature surely all that is pertinent to the successful cold or gas storage, packing and transport of a great array of fruits and vegetables capable of being grown in the tropics. The account is still continuing. [It is to be hoped that this valuable paper will be issued as a separate.—ED.]

1082. SINGH, B. N., AND OTHERS. 664.85.441.035.1 + 664.85.421.035.1

The response of the respiratory system in mango and guava to alteration in the concentrations of oxygen and nitrogen.

Ann. Bot., Lond., 1937, 1 : 311-23, bibl. 10.

This study is concerned with the respiratory behaviour of mangoes and guavas under varying gaseous environments at a temperature of 30° C. in India. A temporary increase of carbon dioxide output was observed in transferring mangoes from cold store at 8° C. to 30° C. and in both fruits on transference from air to an atmosphere of nitrogen and from nitrogen to air. (Guavas are not kept in cold store.) The intensity in the rate of carbon dioxide production on changing from nitrogen to air was directly proportional to the length of the period of anaerobiosis to which the fruit was subject. The carbon dioxide output was at a minimum in 9·2 per cent. oxygen and increased with an increase or decrease of this concentration. A gas mixture of 9·2 per cent. oxygen may be an atmosphere in which the senescent ripening period of mangoes may be prolonged. The reasons for the phenomena noted are discussed.

1083. LEVERTON, R. M. 577.16 : 634.771

Ascorbic acid content of bananas at three stages during ripening.

Food Res., 1937, 2 : 59-63, bibl. 8.

Ascorbic acid was determined by the indophenol-titration method in bananas received from Honduras (variety not stated) at three stages during ripening. Results expressed in milligrams of ascorbic acid per gram of banana pulp averaged ·061, ·063 and ·073 for the bananas at the green, yellow and fully ripe stages respectively. The differences between the mean ascorbic acid content of the green and ripe bananas was $\cdot012 \pm \cdot010$. Although this is not statistically significant, it may be noted that the ripe bananas taken from 21 hands were in every case higher in ascorbic acid than the green ones taken earlier from the same hands.

1084. BAKER, R. E. D., AND WARDLAW, C. W. 632.4 : 664.85

Studies in the pathogenicity of tropical fungi. I. On the types of infection encountered in the storage of certain fruit.

Ann. Bot., Lond., 1937, 1 : 59-65, bibl. 11.

The storage pathogens of certain tropical fruits may be divided into two groups—latent infections established during fruit growth and wound parasites which usually gain access to the tissues during harvesting and storage operations. In this paper the authors identify the fungi isolated from various kinds of fruit from several localities in Trinidad.

1085. ANON (BREMER, A. H., Editor). 664.84.037

Vinterlagring av grønsaker i snø. (**Storage of vegetables in snow.**) [Norwegian, German summary.]

Meld. Stat. Forskst. Grønsak. 17 *Arbeitsåret*, 1936, pp. G. 19-G. 28.

Trials at Ås in the years 1931-1934 and at Trøndelag in Nord-Ostfold in 1936-1937 show that a large number of vegetables can be satisfactorily stored in snow in Norway from September or October right up to the following May. A covering of mossy turf helps to conserve the snow. Vegetables successfully stored in this manner include late varieties of white cabbage, kale, savoy cabbage, cauliflower, leeks, parsnips and garden beets.

1086. BARKER, J., AND MORRIS, T. N. 664.84.31

The storage of asparagus.

Rep. Food Invest. Bd., Lond., for 1936, 1937, pp. 172-3.

Storage life was found to be considerably extended by gas storage, the storage life being greatest when 10% CO₂ and 10% O₂ or 10% CO₂ and 5% O₂ gas mixtures were used. At a temperature of 34° F. the storage life was 35 days in both the above atmospheres and at 41° F. 25 days in each case, as against 25 and <20 days in air at the same temperatures respectively. Asparagus

gathered with young, firm and tight heads kept best. Respiration was high and it is suggested that measures to reduce temperature before loading or to favour loss of heat during transport would be valuable.

1087. MORRIS, T. N., AND BARKER, J. 664.84.656

The storage of peas in pods at 34° F.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 181-2, bibl. 2.

Peas in the pods were stored at 34° F. in a chamber provided with an electric fan. The data obtained indicate that if the pods are in sound and dry condition initially and are protected from evaporation they should have a storage life of at least 3 weeks. The storage of shelled peas is made extremely difficult owing to their bruising and contamination with bacteria during shelling. Such peas when stored quickly deteriorate.

1088. SMITH, W. H. 664.84.356

The storage of broccoli.

Rep. Food Invest. Bd, Lond., for 1936, 1937, pp. 167-72.

It was found possible to store successfully two varieties of broccoli, namely, Sutton's Satisfaction and Sutton's Whitsuntide, for 3 weeks at a temperature of 31°-33° F. with a relative humidity of approximately 95%. A late variety, Late Queen, when subjected to this treatment tended to rapid yellowing of the leaves and to "blowing" of the curd. Notes are given on respiration rates and on the time taken for moulds to appear after removal from store.

1089. WOODMAN, R. M., AND BARNELL, H. R. 664.84.25 + 635.25

The connexion between the keeping qualities of commercial varieties of onions and the rates of water loss during storage.

Ann. appl. Biol., 1937, 24 : 219-35.

Results of experiments on 8 varieties of onion commonly grown in England show that varieties which have a high relative rate of water loss or a high total water loss are definitely non-keeping types and that those with a low relative rate of water loss or a low total water loss are definitely keeping types. It is considered that a simple test carried out over a period of 2 days—the loss in weight from harvest in the 2 succeeding days of a group of onions weighed in the mass—should suffice to place any new variety as a keeping or non-keeping variety.

PACKING, PROCESSING.

1090. HARDING, P. L., AND OTHERS. 634.11-1.564

Influence of packing and handling methods on condition of apples barreled for export.

Tech. Bull. U.S. Dep. Agric. 559, 1937, pp. 25.

By "shaking" is meant the settling of the fruit in the barrel by giving the latter 3 or 4 quick, sharp shakes. By "racking" is meant a vigorous jolting backwards and forwards of the barrel when nearly full with the "plug" (or "follower") in place. The plug is a heavy canvas-covered disc of wood or metal that will fit easily inside the barrel and helps to settle the apples during racking. A series of tests were made in different years whereby the effects of packing tight or loose and of shaking and racking were carefully noted. In general it may be concluded from these observations that shaking the barrels 2 or 3 times during filling, racking 15 times when nearly full with the plug in place and filling to about $\frac{3}{4}$ in. above the top of the staves sufficed to prevent appreciable settling of the apples in transit. Overfilling does not replace shaking and racking in preventing slackness, but it results in excessive bruising in the barrels. Special notes are given on the reactions of the following varieties to the different processes of packing:—York Imperial, Rome Beauty, Jonathan and Grimes Golden apples.

1091. DREYER, D. J. 634.872 : 656.2
The effect of handling practices at Southampton and Nine Elms on the keeping quality of South African grapes.
Bull. Dep. Agric. S. Afr. 161 (Plant Industry Series 10), 1936, pp. 46.

The author describes very fully all the handling processes to which South African grapes are subjected on reaching England before reaching market. He also details the method of examining the consignments at different stages and the results of observations during these examinations. He concludes that ordinary methods result in greater waste and shorter life of the fruit than careful handling and loading of boxes by the skid method. He notes that one remedy for the present wastage would be the elimination of the use of hand barrows and the construction of sufficient shed skids to accommodate all fruits usually stacked on the floor. These skids would be moved into the sheds by means of electric elevating trucks. The road/rail container is recommended as doing away with the present handling at Nine Elms. At present there is not enough loading bank space to allow this method to be adopted, but it is suggested that this could be provided if a larger allotment of quay space could be made, which would provide a loading bank ample for the full use of road/rail containers. The article should be of great interest to all concerned in sending large consignments of grapes to the English markets.

1092. D.S.I.R. LONDON. 664.8
Canning.

Rep. Food Invest. Bd, Lond., for 1936, 1937, Section VII, pp. 185-210.

Canning experiments at the Low Temperature Station, Cambridge, are reported under the following heads:—The corrosion of tin, pp. 185-93; an acid test for tin-plate, pp. 193-5; the corrosion of aluminium, pp. 196-203, bibl. 13; the effect of various methods of storage on the pectin in orange peel, pp. 204-7; lemon peel, p. 207; pectin jellies from the dried albedo of lemons, pp. 207-10; and the behaviour of added vitamin C during the storage of canned apples at ordinary temperatures, p. 210.

1093. AITKEN, H. C. 664.85
Variety canning tests.

Seventy-third annu. Rep. Nova Scotia Fruitgrs Ass. for 1936, 1937, pp. 85-9.

These notes are based on one season's (1935) results of canning tests carried out at the Experiment Station, Kentville, Nova Scotia, and are to be regarded as an indication rather than conclusive evidence. The fruits giving the best all-round results, which include superior colour, flavour, appearance and general canning quality were:—*Strawberries*: Aroma, Claire, Beauty. *Raspberries*: Lloyd George, Newman No. 23. *Cherries*: Montmorency, Morello. *Plums*: Cullin's Golden Gage, Washington, Imperial Gage, Greengage. Among red or purple varieties Hudson River Purple was outstanding. The essential point in producing a good canned plum is to allow it to reach maturity on the tree. *Pears*: In this district Clapp's Favourite canned better as regards flavour than the universal Bartlett. Unfortunately Clapp's Favourite, unlike Bartlett, cannot be held in cold storage prior to canning without changing colour when processed. Beurré Clairgeau also showed promise. *Apples*: The varieties used are not named. It was shown that apples over $2\frac{1}{2}$ inches gave less waste, a higher yield in cans per barrel, required less time and cost less for preparation, and made a more attractive pack in the cans than the smaller sizes. For this reason the canner will pay a higher price for them.

1094. JOHNSON, W. J. B. 664.85.774
Recent developments in the Malayan pineapple canning industry.
Malay. agric. J., 1937, 25 : 270-6.

The progress achieved in the reorganization of the Malayan pineapple canning industry during the last few years is described. A vast improvement has taken place in machinery and hygienic conditions, a voluntary grading scheme similar to the National Mark scheme of England, with distinguishing mark design, has been put into operation, cans have been standardized and

regulations are being made to enforce this for cans under $3\frac{1}{4}$ lb. capacity. To ensure the pineapples arriving in perfect condition at the factory, an essential factor for success, canners are in many cases growing their own fruit. The unsatisfactory aspect is that canners not growing their own fruit compete daily in the fresh fruit market with resultant fluctuation of price and temptation to independent growers to harvest their fruit prematurely when prices are high.

1095. MOTTERN, H. H. 663.813
Concentrated apple juice.

Proc. 32nd annu. Meeting Wash. St. hort. Ass. 1936, 1937, pp. 114-8, bibl. 8.

The attempts to concentrate apple juice so as to leave it with unimpaired flavour are briefly reviewed. The first efforts would appear to have consisted of boiling cider in tanks or barrels, the resulting product being extremely unpalatable. Next, when low temperature evaporation in a vacuum pan failed to preserve the true fresh apple aroma, various partially successful attempts were made to collect the esters released during the process and reimpregnate the product with them. A new type of vacuum concentrator for fruit juice was evolved at Pullman, Washington, the main feature of which was the heating of juice as it passed through a steam jacketed tube. The tube emerged into a separator where the sensible heat of the juice caused sudden evaporation to take place under the vacuum conditions obtaining. The vapours were then separated from the juice and passed on to the condenser to be recombined later with the concentrate. Again it was considered that slow freezing combined with centrifugal action should produce a good concentrate and patents have been granted for apparatus designed for the purpose. It is now also suggested that a combination of freezing concentration, in which the volume of juice is reduced by one-third by freezing, rapid evaporation in which a proportion of the flavour is left in the concentrate and the addition of flavour should be practicable. The U.S. Fruit and Vegetable Products Laboratory at Pullman in co-operation with the State College of Washington is at work on these lines. It is also studying methods of classification of apple juice and its preservation by flash pasteurization.

1096. CLAGUE, J. A., AND FELLERS, C. R. 663.3
Apple cider and cider products.

Bull. Mass. agric. Exp. Sta. 336, 1936, pp. 35, bibl. 26.

The authors give a brief account of the processing methods which have been found most successful in the preparation of apple juice, fermented and unfermented, in Massachusetts, considerable attention being paid to the experience gained in other states and countries. Notes are also given on the preparation of the following concentrated cider products:—boiled cider, cider syrup, cider jelly.

1097. PEDERSON, C. S. 663.813 : 634.8
The preservation of grape juice. 1. Pasteurization of Concord grape juice.

Food Res., 1936, 1 : 9-27, bibl. 10.

A study was made of the pasteurization temperatures necessary for the killing of micro-organisms, particularly moulds, in Concord grape juice. The results indicate that the juice can be pasteurized successfully, using ordinary precautions, at temperatures considerably lower than those used at present in the industry. A temperature of $71\cdot1^{\circ}$ C. (160° F.) appears to be sufficient, since moulds, which are more resistant to heat than yeasts and bacteria, are apparently unable to withstand temperatures much above $68\cdot3^{\circ}$ C. (155° F.), although to be on the safe side a pasteurization temperature of $73\cdot6^{\circ}$ to $76\cdot7^{\circ}$ C. (165° to 170° F.) would be preferable. Lower temperatures used in pasteurization, however, did not alone improve flavour, aroma and colour, nor retard precipitation in the juice. Spoilage by mould growth occurring in carboys following pasteurization is thought to be due in some cases to the use of contaminated corks, and it is suggested that these might be dipped in hot paraffin immediately before use. Corks which

have been pushed into the carboys when previously used should be removed. Heat penetration curves showing the rate of transmission of heat to the centres of various bottles containing grape juice are presented.

1098. TRESSLER, D. K., AND PEDERSON, C. S. 663.813 : 634.8
Preservation of grape juice. 2. Factors controlling the rate of deterioration of bottled Concord juice.
Food Res., 1936, 1 : 87-97, bibl. 4.

Pasteurized Concord grape juice stored under a high vacuum or in bottles containing substantially no oxygen undergoes very little change even when exposed to light at room temperature. The juice in partially filled bottles deteriorates rapidly. The changes noted are the clouding of the juice, a change from bright purple-red to a brown colour, a slow deposition of a brown sediment leaving an amber coloured juice, and a detrimental change in aroma and flavour. These changes occur more rapidly at room temperature than at lower temperatures. Light, particularly that of short wavelength, accelerates these changes. Commercially bottled grape juice has been subject to the oxidative changes described above since the air has not been eliminated from the bottle. Concord grape juice which has never been heated does not keep well even though it is sterile and kept in absence of oxygen. Concord grape juice seems to keep equally well in soft glass, hard (resistance) glass, and pyrex glass containers. Heating at 73.9° C. (165° F.) for 30 minutes is sufficient to destroy the micro-organisms in the juice, so that it will keep satisfactorily in bottles containing little or no oxygen in the head space. [Authors' conclusions.]

1099. AIYAR, S. P. 634.3-1.57
The preparation of useful products from citrus fruits.
Bull. Dep. Agric. Burma 34, 1937, pp. 6, bibl. 13.

The following products were prepared on a small scale by laboratory methods from the Burmese sour lime, *Citrus medica* var. *acida* :—(1) lime juice, sweetened and unsweetened, by means of filtration with sodium salicylate as the preservative ; (2) calcium citrate by means of neutralizing lime juice with slaked lime ; (3) oil of limes ; and (4) solid pectin. The method of preparation used in each case is described, but it is noted that at least one of the products, calcium citrate, could not be profitably manufactured in Burma at the present low level of world prices.

1100. WILBAUX, R. 633.73-1.56
Recherches préliminaires sur la préparation du café par voie humide. (The preparation of coffee by the "wet" method.)
Publ. Inst. nat. Étude agron. Congo belge, sér. tech., 13, 1937, pp. 50, bibl. 16.

A full account is given of the process of preparing *robusta* coffee by the wet method of fermentation. Careful notes are made of the chemical and physical changes occurring during the process and the effect of varying the details of this process on the final product is discussed. Among the conclusions reached are the following :—(1) Fermentation is started by very active enzyme action. Coffee prepared without fermentation is, in view of results of the experiments reported here, thought to be just as good as that submitted to fermentation. (2) The water used in fermentation must be very clear and should contain extremely little, if any, iron. (3) The maceration of berries prior to depulping should not be carried out, and there should be no necessity for it, if the berries are picked at the proper stage of ripeness. (4) Drying is of the greatest importance. Excessive temperature at the end of the process results in red colouration, while a too lengthy exposure to drying increases the number of grains with the testa adhering to the endosperm. (5) The state of ripeness at picking is very important and, if berries of different ripeness are submitted to fermentation, the final product will be mottled in colour. (6) A method of titrating the acidity of green coffee has been worked out. The test is a delicate one, but, except for coffees of great acidity (3.9-4.4 c.c. N/10 per 10 g.), the information thus obtained does not throw any light on the mode of preparation or the quality of the product.

1101. SIPPLE, H. L. 635.64 : 663.813
Control of concentration in the production of tomato pulp and paste.
Food Res., 1936, 1 : 145-62.

Tomato pulps and pastes are sold on the basis of their total solids content, and the relationship existing between this content and the refractive index of the serum has provided a means of determining rapidly the various stages reached in the concentration of the pulp. Hitherto, however, the difficulty of separating sufficient clear serum for refractive index measurements has prevented this method from being used for pastes containing more than 20% total solids. The present paper describes a method whereby the refractive index may be used in computing the total solids in pastes of the most concentrated type, and presents a computation table for the range 9·00% to 37·00% total solids at 0·05% intervals. This table provides the following information:—The total solids determined in vacuo at 70° C. and specific gravity at 20° C. of whole tomato paste; and the immersion refractometer reading at 20° C. and the refractive index at 20° C. of both the filtrate from whole tomato paste and the filtrate from whole tomato paste diluted in the ratio 1 gram paste : 2 ml. H₂O at 25° C. Tables showing the corrections for temperature of the immersion and the Abbé refractometer readings are also provided.

1102. WILBAUX, R. 665.353.4
Quelques données sur l'épuration de l'huile de palme. (Some data on the refining of palm oil.)

Publ. Inst. nat. Étude agron. Congo belge, sér tech., 11, 1937, pp. 16, bibl. 3.

The author gives an account of trials in the Belgian Congo of Laval centrifuges for purifying crude palm oil and of the use of the Titan Sludge Separator. [A full account of the use of the latter may also be found in the *Malayan Agricultural Journal*, 1935, Vol. 23, pp. 361-8.—Ed.]

1103. MACLINN, W. A., AND FELLERS, C. R. 664.8
Vacuum determination in all-glass canning jars.
Food Res., 1931, 1 : 41-4.

The vacuum desiccator and water displacement methods of determining the vacuum in all-glass preserving jars are described. Both methods are reasonably accurate, easy to manipulate, and have proved valuable in the laboratory examination of foods canned in glass. [Authors' summary.]

1104. CAMERON, E. J., AND OTHERS. 635.11 : 664.84.11
The cause of "black beets": An example of oligodynamic action as a contributory cause of spoilage.
Food Res., 1936, 1 : 73-84, bibl. 2.

The type of spoilage in canned beetroot, known as "black beets" is due to understerilization; but the study described here has shown that, for the surviving bacteria to produce their characteristic effect, an abnormally high amount of iron must be present in the beet juice. An explanation is given of the apparent function of the iron.

NOTES ON BOOKS AND REPORTS.*

1105. LAWRENCE, W. J. C. 631.523 : 634/5
Practical plant breeding.

George Allen and Unwin, London, 1937, pp. 155, 5s. 6d.

This is an extremely valuable little book, likely to prove of interest and use, not only to the gardener, both amateur and professional, interested in the improvement of plants, but also to the student to whom an elementary knowledge of genetics and cytology is necessary. Several excellent text books upon these subjects have come from Merton during recent years, written by specialists in their own particular lines of work, making available for the advanced student and research worker the latest discoveries and conclusions of cytogenetic research. In general,

* See also 987, 1016, 1025, 1041.

however, these books have been addressed to scientific audiences, assumed to be already in possession of an elementary knowledge of the subject, and have been couched in language not always very comprehensible to the layman. The need must long have been felt for a simple exposition, in plain, non-technical language of the salient principles of genetics and cytology with suggestions as to how this information might be utilized by the practical horticulturist in breeding new and improved races of plants. Mr. Lawrence's little book should admirably fill this need. He starts out from the beginning and explains in simple, easily understandable language, the structure of flowers and the technique of artificially fertilizing them. He then explains the laws according to which the characters are inherited, leading on from the simple ratios to be expected from segregation in diploid plants to the much more complicated ratios encountered in polyploids. Mr. Lawrence then goes on to describe the mechanical background of chromosomes within the nucleus of the plant cell, by which this orderly segregation of characters is operated, and to point out the rôle of chromosome aberration in bringing about such phenomena as sterility. Finally, he shows the would-be plant breeder how he can utilize this information to the best advantage in breeding improved races of plants. At every stage, the book is illustrated with excellent photographs, drawings and diagrams which add very materially to a clear understanding of the text. Sir A. D. Hall contributes a foreword. It might, perhaps, be worth pointing out an error in the text which, although slight in itself, might lead to confusion. On page 119, on the last line, Mr. Lawrence speaks of "plants which can be multiplied sexually" where it is quite obvious that he means "plants which can be multiplied asexually!" This book should make a wide appeal to all those interested in plants and their improvement.

H.M.T.

1106. HOARE, A. H.

634.11

Commercial apple growing.

Martin Hopkinson, London, 1937, pp. 245, 10s.

An important contribution to English pomology. With a nice sense of proportion the author has drawn his material equally from the experiments of research workers and from the empirical findings of successful fruitgrowers. Fruitgrowers will be grateful to Mr. Hoare for treating them as intelligent human beings, a status too long denied them by the writers of horticultural text books. Research workers will welcome the book as a serious attempt to present the commercial apple plantation with all its environmental complex as a place in which it is not impossible "to see the wood for the trees". The chapters on pruning, manuring and soil management give able summaries of modern ideas on the subjects although little attempt is made to deal with their interactions. In a chapter on some factors affecting tree performance the author takes us gallantly out to cruise in what some might consider the yet uncharted seas of pomological and physiological investigation. June drop, thinning and biennial bearing are treated with admirable discretion, and Mr. Hoare brings his craft safely back to terra firma through a section on hail and wind. The chapter on storage gives clear descriptions of ventilated, cold, and gas stores and contains some interesting costings. The author ranks spraying as the most important of all the routine practices of orchard management, and the chapter on this subject is exceptionally well-written. Intending planters would do well to ponder carefully the facts and figures set out in the final chapter on finance, and especially Mr. Hoare's estimates, in his Personal Note, of the initial and working capital required for commercial fruitgrowing. Those with £6,000 in hand and a little reserve in the bank, may then turn back to the table of cash returns per acre on page 225, for a really happy ending to a most stimulating book. N.B.B.

1107. BOIS, D.

663 : 633/635

Les plantes alimentaires. IV. Les plantes à boissons. (Beverage plants.)

Paul Lechevalier, Paris, 1937, pp. 600, frs. 120.

This book forms volume 17 of the *Encyclopédie biologique* and is the 4th and final volume of the section "Les plantes alimentaires" of which nos. 1, 2 and 3 treating respectively of vegetables, fruits and spices have been published between 1927 and 1934. In the first part of the volume under review are taken (metaphorically) the cups that cheer, while in the second those that do not inebriate are dealt with. Pliny enumerates in his *Historia naturalis* sixty-six different

kinds of potable fermented liquors made from fruits or herbs; the author with all the exotic concoctions of the New and the then unknown parts of the Old World on which to draw has naturally been able to treat of many more. The method used throughout the book for each plant, so far as the information is available, is to begin with an introductory sketch, mainly historical, in the course of which the earliest origins are discovered and the anecdote is not despised, to continue with a description of the principal botanical varieties in use, with brief notes on their origin, habit and peculiarities, and to conclude with a series of notes on the biochemistry, economics, climatology, cultivation, and pests and diseases of the genus concerned. Though the author informs us that the minutiae have been left to the technical handbooks, he has, nevertheless, managed to assemble a vast amount of useful information which but for his untiring effort would otherwise not be available without a great deal of research. Little seems to have been overlooked. As an instance of this thoroughness may be cited a list of 72 plants which can be or are used as substitutes for tea, though probably not always to the complete satisfaction of the drinker. The arrangement of the book is not of the easiest for rapid consultation, since, except for the rough division already referred to, the position assigned to the plants is more or less arbitrary and there are no tables of contents and no page headings, though the very full index, which in this volume comprises also the subject matter of the previous three, goes very far to minimize any inconvenience. It is a pity that there is no bibliography, its interest would have been great, but possibly its inclusion would have swollen the book beyond reasonable limits. And finally, if the conscientious reviewer may be permitted a small moan, is it really necessary to keep him straining at the leash of his desire to assimilate the contents of the book by first forcing him to cut nearly six hundred pages?

1108. HOLLAND, J. H. 631.57
Overseas plant products.
 John Bale, Sons and Curnow, London, pp. 279, 6s.
 The overseas plant products enumerated in this book comprise all the natural products of vegetable origin imported on a commercial scale into the United Kingdom and some others of economic value in the country of production. The products are arranged alphabetically through the book under the trade or vernacular names which are correlated with the generic, specific and the botanical family names. Some indication of the uses of each product is given, the author regretting that lack of space prevents a fuller account. The entries number some 2,500 and the book concludes with a useful classified bibliography.
1109. DALZIEL, J. M. 633 + 634 + 635
The useful plants of west tropical Africa.
 Crown Agents for the Colonies, London, pp. 612, 18s.
 The book forms an appendix to the "Flora of West Tropical Africa" by J. Hutchinson and J. M. Dalziel. In the present publication the record is confined to the flowering plants of West Africa in common use, though not necessarily indigenous to the country. Certain introduced plants such as cacao and Para rubber are not included, though others such as mango and cassava are. The arrangement of the book follows a botanical system except that the species are arranged alphabetically within the genus. In the majority of cases it has been possible to indicate the domestic, commercial, medicinal and other uses to which the plant is put, some of the notes being very full and all being interesting. The vernacular names used in the numerous dialects of West Africa have been given for each plant, the utmost pains having been taken with the verifications and all doubtful renderings excluded. The book concludes with indexes to the vernacular names, to the common names, mainly English or French, and to the scientific names.

1110. BROOKLYN BOTANIC GARDEN. 58.006
Botanic gardens of the world. Materials for a history.

Brooklyn bot. Gdn Rec., 1937, 26 : 149-353.

This American publication aims at providing concise information on each of the botanic gardens, past or present, of the world. The information consists, where possible, of a list and dates of

directors from the foundation of the garden and notes on the acreage, herbaria, libraries, etc. Much of it is meagre, many entries containing the address only, but the larger gardens have been fairly fully dealt with, particularly those of Europe and U.S.A. There is no index, the entries being alphabetically arranged through the book, and confusion as to the designations and possibly the geography of the dependencies of other nations makes reference often a little uncertain. For instance under British West Indies we find Jamaica and St. Vincent only, Grenada and St. Lucia being at the other end of the volume under Windward Islands, while British Guiana and Trinidad are under B and T respectively. The other islands are not mentioned. Singapore appears twice, misplaced but at some length under Federated Malay States and again under Straits Settlements, its correct position. Here, however, it receives but one line and no cross-reference, so that the fact that it is fully described under another heading is not obvious. The Dutch East Indies and the Netherland East Indies are considered to be two different places, at least there is a different botanic garden assigned to each. But it is ungracious to carp since the effort has entailed an enormous amount of work, and, so long as the reader realizes that, because an entry is not where he expects it to be, it has not necessarily been omitted, the book should prove useful. As usual in cases where information has to be sought by questionnaire not all the bread cast so hopefully upon the waters has been gathered in again even after many days and this accounts for most of the omissions. It is interesting to note the antiquity of some of those gardens which are still flourishing. Leiden for instance since 1587 with an unbroken succession of 18 Directors, and, oldest in Great Britain, Oxford University, 1621, with the further distinction of having owned the first greenhouse to be erected in England.

1111. AMANI RESEARCH STATION.

63

8th Annu. Rep. E. Afr. agric. Res. Stat., Amani, for 1935-6, 1936, pp. 41, bibl. 32, 1s.

Sisal. Reference is made to the benefits to be expected from collaboration with the new Sisal Experiment Station, Tanga, and with the Linen Industry Research Station at Lambeg in N. Ireland and the necessity for careful co-ordination which should extend to the private experiments being supported by the Colonial Development Fund. The blue sisal, *Agave amaniensis*, is for the first time being grown on a scale sufficient to allow of an adequate agricultural and commercial estimation. Selection in connexion with fibre qualities is still awaiting guidance from the users as to the direction it should take. *Coffee.* The outstanding problem is the estimation of liquoring quality. Here again no consistent standards of measurement exist in the trade and the findings on numerous samples submitted to professional estimation in England could be neither correlated with the circumstances of production nor even with one another. *Cinchona.* Local development has been held up in spite of widespread seed distribution from Amani and a suitable climate, chiefly for lack of skilled horticultural attention in the stages of germination and early growth. *Insecticides.* Local conditions have proved highly suitable for derris. Work in progress on the native tree *Mundulea suberosa* has disclosed an efficacy of the bark equal to derris, combined, however, with a considerable variation in quality between individuals. *Tung oil.* *Aleurites montana* flourishes while *A. Fordii* does not. The habit of the trees to exhibit a continuous series from some bearing purely male to others bearing purely female flowers is a problem of which the implications as regards cropping are not yet fully known, but topworking is possible and will probably be necessary. These notes are taken from the Director's report: brief reports are also provided by various specialist officers of the station and are not referred to in detail here since those features of interest to this Bureau have been already elaborated elsewhere and abstracted in this journal.

1112. CEYLON, DEPARTMENT OF AGRICULTURE.

63

Administration Report of the Acting Director of Agriculture for 1935, Dec. 1936, pp. 105, Re. 1.10.

In addition to the usual administrative facts and figures, reports from the specialist officers are included, from which the following notes are taken. *Papaw.* Planting experiments with *Carica Papaya* L. indicate that an initial sowing of 4 seeds to a hole is necessary to ensure that

each hole contains a fruiting plant. Individual tree records of fruit and latex yield are being kept. *Citronella* oil. A new station is to be established for experimental and selection work on *Cymbopogon* varieties. *Cinchona*. Methods *in esse* and *in posse* in connexion with the re-establishment of the quinine industry are mentioned. An essential preliminary is an increase in the quinine content of the bark over that now available. Other crops. The work in progress on castor (*Ricinus communis*) and gingelly (*Sesamum indicum* L.) is briefly described. The local varieties of banana, of which some 60 have been recorded, are being studied with a view to a monograph on the subject. The germination of the polyembryonic seeds of mango and citrus is being studied to discover, if possible, some constant characteristic by which the sexual embryo may be distinguished at an early date.

1113. IMPERIAL COLLEGE OF TROPICAL AGRICULTURE, TRINIDAD. 63

Principal's Report for the year 1935-6, pp. 36.

The report is of interest for its brief summary of the results so far obtained in the solution of various problems under investigation at the Imperial College and for the programme of future work. Progress reports of much of this work have already been separately issued and noticed in one or other of the abstracting journals of the Imperial Bureaux. A bibliography is given of the scientific papers, 47 in number, prepared or published during 1936. The accounts for the year ending 31 August, 1936, are also given.

1114. JAMAICA, DEPARTMENT OF AGRICULTURE. 63

Annu. Rep. Dep. Sci. Agric., Jamaica, for 1935, 1936, pp. 91.

An interesting feature of this report is an account of the newly opened Low Temperature and Marketing Station and of the subsequent rapid expansion of the work carried out there. Originally intended for experimental work only, the Station is now, in addition, operated on the lines of a Government Marketing Agency to handle exports of new agricultural products for growers prepared to share with the Department in the exploration of overseas markets, while plant import and export inspections, experimental plots in vegetables and certain new crops, overhead irrigation and Citrus Development Loan work were also brought under its control. Much information is given as to the results of experiments in the storing, packing and marketing of various fruits and vegetables. The above covers, of course, but a section of the many activities of the Department which are comprehensively dealt with in the Report. How numerous and almost startlingly varied these are, a glance at the very useful index will show.

1115. PALESTINE, DEPARTMENT OF AGRICULTURE. 63

Annu. Rep. Dep. Agric. for year ending March 1936, pp. 209, 100 Mils.

There were ten horticultural experiment stations operating throughout the year, most of them, however, being in an embryo state, having only recently been planted up. Four are in the hills, 3 in the plains and 3 below sea level. A general scheme for recording annually measurements of growth of deciduous trees was initiated at all stations. Girth measurements were taken above and below the bud union and compatibility of stock and scion was noted. October pruning at some stations for apricots, peaches, plums, almonds, apples and pears was found in both hill and plain to advance growth as compared with the usual winter pruning, though it proved detrimental to some fruits in the plains. In the citrus groves at Acre Experiment Station *Crotalaria juncea* and *Sesbania aegyptiaca*, grown as temporary windbreaks, gave considerable protection during summer. In the fruit orchard the early development of plum trees from India, apples from Syria and early pears from U.S.A. was noticeable. *Citrus*. Planting distance of 4×5 m. and 5×5 m. afford more protection from wind and sun than spacing 7×7 m. In irrigation experiments now in their fifth year best development appears to result from the 10 days interval. Rootstock experiments indicate that for Jericho conditions rough lemon is the best stock and sour orange the second. Sweet lime shows poor results. The observations refer to the general health and development of the trees. Yield records were not included. Dates. In drying experiments dates treated with sulphur fumes and dried 4 days only in the sun were superior to those treated with carbon bisulphide gas or dried for 5 days. Papaws. The

new shoots springing from decapitated male trees gave male flowers in each case. *Loquats* budded on loquat gave far better results than those on quince. *Almonds*. Selections of bitter almond seeds collected in Palestine for resistance to *Capnodis* are being raised for rootstock trials and propagation experiments. They will be budded with apricots, peaches and plums.

1116. RUBBER RESEARCH SCHEME, CEYLON.

633.912

Report of the Work of the Rubber Research Board in 1936, 1937, pp. 87.

The report notes the centralization of headquarters at Dartonfield. Research during the period under review was necessarily limited and the report is concerned mainly with notes on local conditions, routine and demonstration work. Matters concerning the after-treatment of latex and the uses and qualities of various types of rubber are discussed. An experiment in the budding of 58 trees about 25 years old succeeded with 3 trees only. Four buds were applied to each tree, 2 on virgin and 2 on well matured renewed bark. The trees had been previously well manured and tapping had been stopped.

1117. TRINIDAD AND TOBAGO.

63

Administration Report of the Director of Agriculture for the year 1936, 1937, pp. 67, 48 c.

The report contains notes on a large number of experiments. Some results are given below.

Cacao. At River Estate sulphate of ammonia applied alone or with other manures has usually caused diminished yields. Muriate of potash (stores badly) and sulphate of potash (expensive) proved equally and highly beneficial. Phosphatic manures while of some value alone greatly enhance the value of potassic manures. The values of potash and phosphates are greatly increased by the addition of organic manure. Cacao under partial shade gave better response to manuring than cacao grown under no shade. The latter is an unnatural condition for Trinidad but normal in Grenada, in which island benefit was derived by the use of Ammophos. The manurial experiments at Marper Estate, which are here summarized, have already been critically examined in *Trop. Agriculture*, 1936, 13 : 233-41; *H.A.*, 1936, 6 : 911. Seedlings from a high-bearing tree No. 4927 have now reached maturity and are giving yields well above the normal for the estate. Of various methods tried for returning organic matter to the soil the system of long shallow trenches has proved most efficient. An equally effective method now being preferred to trenching, especially on estates made up of the 2 row and a drain system, is to form turtle-backed beds of organic matter lightly covered with soil on the ground between the drains. Liming at the rate of 1-2 tons per acre should precede this round ridging. In combined shade reduction and drainage experiments, when close drains (26 ft. apart) were used, the highest yield occurred where the shade reduction was most drastic, but with no drains the reverse was the case.

Tonka beans. The tonka bean was shown to respond vigorously when young to cultural treatment, contrary to local belief. Old trees with a habit of biennial or even triennial bearing were less responsive, but evidence points to older starved trees requiring a pronounced "jolt" to start them into activity. An experiment on layered *versus* seedling plots is in progress.

Citrus. The following citrus experiments are in progress, some being too recent for analysis:—Stock trial for grapefruit. A stock variety plot in which rootstock varieties are tested for relative growth, disease resistance, etc., as seedlings, layers and budded on their own seedling varieties. With grapefruit and Valencia oranges height of budding, 2-25 in., had no effect on shape or vigour of scion. Cultural treatment trials (i.e. forking, cutlassing, cover cropping) on 3 varieties of grapefruit on sour orange stocks. In manurial trials the greatest growth response comes from single nitrogen + pen manure + phosphates.

1118. UGANDA, DEPARTMENT OF AGRICULTURE.

63

Annu. Rep. Dep. Agric., Uganda, for year ending 31 Dec., 1936, 1937, pt. I, pp. 35, 2s.

This report reviews the agricultural situation in the Protectorate during 1936 and contains notes of work in the field and on agricultural education. For Part II, dealing with experimental work, see Abstract 1119.

1119. UGANDA, DEPARTMENT OF AGRICULTURE.

63

Annu. Rep. Dep. Agric., Uganda, for year ending 30 June, 1936,
1936, pt. II, pp. 123, 5s.

The following results of experiments are noted.

Coffee : soil treatment and plant growth. In an experiment at Kampala coffee trees on plots in which the weeds are slashed only are yellow and unhealthy ; those interplanted with *Centrosema pubescens* are green and healthy in wet weather but suffer from the root competition of the cover crop during dry weather ; on the clean weeded and on the mulched plots the coffee has made strong growth.

Pruning. The agobiada system for both *arabica* and *robusta* gave the highest yield per tree. An expedition was made to study wild coffee on the Sudan-Uganda border and a *robusta* variety with narrower leaves and longer fruits than the type and growing under drier conditions was secured for its possible breeding value.

Tea. Records show that in comparison with many tea producing countries there is a relatively small seasonal variation in leaf production ; peaks of leaf production usually occur after heavy rainfall. The maximum seed production is in the months of May, June and July.

Oil Palm. Introduced new varieties are showing heavier yields and better type of fruit than the older palms which have been established in the country for many years ; the poor results hitherto obtained from the older tree may, therefore, be due to genetic rather than climatic causes.

Citrus. Rough lemon proved a strong growing stock compatible with grapefruit, oranges and tangerines. On sour orange and pomelo stock the buds, except tangerine, took well ; later growth, however, was poor and the shoots were stunted and chlorotic.

Sweet potatoes. No significant difference in yield was found between hill and ridge cultivation and the latter method is also effective against soil erosion. Native objections to it are probably because the ridges are usually not large enough and so restrict root expansion. In fertility experiments in which the crops were cotton, *Eleusine* and cotton, and ground nuts in successive years no significant differences in yield were obtained between green manure (*Crotalaria juncea*), green manure and lime, and farmyard manure, 10, 20 and 30 tons per acre. There was, however, a significant difference in the cash returns in favour of the farmyard manure over the lime treatment but not over the control.

Essential oils. Geranium oil made from *Pelargonium pinnatum* proved to be of little commercial value but that made from *P. radula* was considered to have market possibilities. Oil of rosemary produced in Uganda had the normal characters of European distilled rosemary oil though with a somewhat inferior odour. Lemon grass oil made from a local high-yielding strain (Mityana) and a low-yielding strain (Kampala) were commercially identical and would be readily saleable.

1120. ARGLES, G. K.

634.1/2-1.541.1

*A review of the literature on stock-scion incompatibility in fruit trees, with particular reference to pome and stone fruits.**Tech. Comm. Imp. Bur. Fruit Prod.* 9, 1937, pp. 113, bibl. 194, 5s.

The manifestations or symptoms of incompatibility in fruit trees are considered and the possible causes are discussed. The compatibility or incompatibility shown by individual species of common deciduous fruit trees towards particular rootstocks is studied. Certain general conclusions are reached with regard to both symptoms and cause of inherent incompatibility and tentative suggestions are made for drawing up a research programme to deal with the problem. In an appendix covering 40 pages the author has tabulated the extremely numerous and often contradictory records of compatibility and incompatibility between particular varieties of fruit trees and particular rootstocks. The appendix adds greatly to the reference value of this publication.

Attention is drawn to :—

1. The Bureau's proposal, subject to adequate support, to call a second Imperial Horticultural Conference which will meet in London on 5th to 9th August 1938, immediately before the 12th International Horticultural Congress, Berlin, 12th to 19th August. Proceedings will be published and available to all.
2. Change of name to Imperial Bureau of Horticulture and Plantation Crops.
See Note 3.
3. Revised prices for Horticultural Abstracts as from Vol. VIII, 1938. Price to subscribers in countries in British Commonwealth of Nations 20/- a volume or 5/- a number. Price to subscribers in other countries 25/- a volume or 6/6 a number.
See Note 1.
4. Proposal to discontinue use of Universal Decimal Classification Numbers at head of each abstract.
See Note 2.

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Errata Vol. VI.

Abstract 427, lines 5-7, *omit from* The strengths . . .
to metre, *and substitute* The formalin solutions used
were 0·1, 0·3, 0·5 and 0·8 formalin diluted with
water to 5 litres and used on 1 sq. metre and
0·8 formalin diluted with water to 10 litres and
used on 1 sq. metre.

Errata Vol. VII.

Abstract 131, line 2, *for* magnesium *read* manganese.

Abstract 489, line 3 of heading, *for* 1937 *read* 1936.

Abstract 547, line 3 of heading, *for* Bedeutung *read*
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